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H. C. PARMELEE, Editor

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Pink Gasoline for A Whimsical Public

OUR news pages of Dec. 19 contained a short item in which a chemical engineer of the Bureau of Mines suggested the desirability of coloring gasoline red in order to call attention to certain hazards in its transportation and use. Judging from the wide publicity the idea has received in the newspapers, it would seem to hold considerable attraction for the layman. It is our belief that in some ways it should prove even more attractive from the point of view of the industry.

To be sure, the idea is not exactly a novel one to the oil refiner, for even now the gasoline exported to certain countries must be conspicuously colored; also during the war the army and navy adopted a somewhat similar scheme for identifying the "fighting grade" of aviation fuel. A predominating proportion of gasoline, however, is refined water-white simply because the great automobile-driving public has been taught to accept no other grade. This is not the result of a deliberate educational campaign on the part of the petroleum industry; rather it is a condition more or less forced on that industry by competition. The public associates color with impurity, and the easiest way out for the oil industry was to call on the chemist and chemical engineer to take out the color. The desired result has been attained remarkably well, even though the process has undoubtedly added something to the cost of the product and at the same time actually lessened its performance value. In order to satisfy this whim of the public for water-white gasoline, the petroleum refiner has consented to make the sacrifice. He has given little or no thought to the possibility that the whim might be changed; that red gasoline might just as well become the order of the day. But to accomplish such a program would require salesmanship—an element that Henry L. Doherty tells us is unfortunately lacking in the make-up of the oil industry.

Recently we listened to a story that is worth repeating in this connection. It was about a South Carolinan oil dealer who, during the war when motor fuel was really scarce, discovered that his whole supply consisted of a tank car of badly off-color gasoline. His tank wagons had scarcely made their first deliveries to the filling stations before the complaints started coming in. Finally, on the verge of desperation, the big idea came to the poor fellow. He had conceived an answer for the next complainant. The despised fluid was suddenly christened "that wonderful Sun-kist gasoline—made from golden California crude." Its reputation was immediately established and long after the supply was exhausted the poor dealer was still explaining how the prohibitive transcontinental freight rates had forced his refiner to turn again to Mid-Continent crudes that yielded only the insipid and colorless distillates.

Of course, "Sun-kist" gasoline is not going to be the solution for the color problem of the petroleum refiner, and probably there are many reasons why the Bureau of Mines scheme will prove impractical. But the real answer will come when the oil industry awakes to its opportunities—when by good salesmanship it can create a demand rather than serving willy-nilly the fads and fancies of a whimsical public.

Mercury and Steam Production

ELSEWHERE in this issue the reader will note an article on the mercury-steam boiler system invented by W. L. R. Emmet. Backed by the resources of the General Electric Co., this device, long dreamed of by inventors, has been developed to a point where successful operation is assured. Theoretically, such a system of heat utilization permits increased efficiency of about 100 per cent over the present steam boiler-steam turbine plant. In practice, at the test installation of the Hartford Electric Light Co., the increase in output of electric power per pound of fuel is about 50 per cent, while with boilers specially adapted to the process, not revamped from existing equipment, the inventor confidently expects an increase in efficiency as high as 80 per cent over the present practice of steam-power plants.

But, rosy as this picture may seem, it would be a mistake to jump to the conclusion that the fuel bills of the power plant are likely soon to be cut in half. Look for a moment at these figures. The present Emmet boiler contains about 30,000 lb. of mercury and generates steam enough to supply 4,100 kw. of electric current. This means 7.3 lb. of mercury per kilowatt capacity. The inventor promises equipment needing only 4 lb. of mercury per kilowatt. Now our mining engineer friends tell us that the 1921 world production of mercury was only 4,451,000 lb. and that the total world production from 1908 to 1921 was 110,337,000 lb. This, using the inventor's best figure of 4 lb. per kilowatt, would mean that in 14 years the world produced only enough mercury to supply power plants of the Emmet design with a capacity of 27,500,000 kw. Certainly, that amount of power wouldn't go far toward providing the world's needs, even though it implies that all the mercury produced should be used for power generation alone. And the miners tell us further there is little hope for great increase in mercury production.

So here is our rosy picture painted black! But perhaps not so black as it may seem. For while a limited supply of mercury may restrict the development of the

mercury boiler plant, it does not prevent the consideration of similar binary vapor systems. This suggests that where one inventor has succeeded with the vapors of mercury and water, others may yet succeed with other combinations. The successful Emmet boiler should stimulate experiment to the end that the promised fuel saving may be realized in a system that uses vapors at once cheap and plentiful. Thus may physical chemistry and chemical engineering contribute to the production of cheaper power.

Company vs. Individual Credit For Achievements in Research

EACH week on the opening page of a well-known commercial and financial magazine appears the conspicuous title: "The Lookout in the Foretop." Presumably it is from this vantage point that the editor observes the trend of business, the budding developments that presage changes in industrial and economic conditions. In following our own humble calling we have not openly aspired to such high places of observation, yet we have held it our bounden duty occasionally to pull ourselves out and above the daily happenings in chemical engineering in order to look out on the progress and prospects of our industries. Editorial obligations are not unlike those of an advance guard that pushes forward to explore and to warn of dangers ahead.

It was in serving such a purpose that we recently called the attention of our industries to the inception of what we regarded as a dangerous trend in industrial research. We referred to the policy adopted by the research organization of a large British company whereby the results of investigation were made public in the name of the company rather than over the signatures of the individual investigators. We pointed out that in our opinion the practice threatened to rob research of one of its chiefest incentives. It substituted mass effort for individual initiative.

We have had no reason to revise our opinion in this regard, but we are glad to publish in this issue a letter of explanation signed by the entire staff of the Research Laboratories of the General Electric Co., Ltd., of London. We can take no exception to the unselfish and laudable reasons that have led to their adoption of this practice. But the fact that it operates satisfactorily in this particular instance does not mean that it can or should be applied generally throughout industry. The notable contributions of fundamental knowledge resulting from the researches of this great organization and its affiliated companies have won for it an inestimable standing in science as well as industry. There is no one to question or impugn the motives that have prompted such fundamental inquiries as those of Langmuir, Whitney, Fink and Coolidge.

On the other hand, there are commercial organizations in this country (and we have no reason to believe that the United States is unique in this regard) the public announcements of which are always regarded with suspicion. They have shown no desire to share with others in their technical accomplishments. Their motives are solely those of sordid profits and immediate gain. To substitute company responsibility for that of the individual in such cases would merely help them to further their own selfish purposes.

Efficiency, Ventilation And the Human Machine

TEN years or so ago an experiment was performed that resulted in a new interpretation by science on the needs of the human machine so far as atmospheric conditions are concerned. Eight students were placed in an airtight chamber of about 3 cu.m. capacity, in which the movement of the air, the humidity and the temperature could be regulated. The experiment was started with the air quiescent, at normal humidity and temperature. The men were confined in the chamber until the percentage of CO_2 reached 4—in which the amount of oxygen present was insufficient to support the combustion of a lighted match. The wet-bulb thermometer showed 83 deg. F., the dry bulb a little more. The men began to suffer keenly; their faces became flushed, and skin and clothes were moist with perspiration. The pulse rose to an average of 97, and there was every evidence of physical distress. Without making any alteration in the composition of the air within the chamber, it was set in motion. Immediate relief was experienced, the average pulse dropping to 79 and other evidence showing that discomfort had been alleviated to a marked degree.

The pioneer of this research was Dr. Leonard E. Hill, an eminent physiologist, who devised an instrument, known as the katathermometer, to record the relative cooling power of the atmosphere. He argued, logically, that the human body is a dynamic machine that consumes food and produces energy and heat. The excess heat must be dissipated into the atmosphere. The ordinary thermometer is useless as a means of indicating the conditions under which comfort and efficient performance are secured, hence the katathermometer.

Subsequently another investigator, H. I. Ireland, summarized Dr. Hill's findings, as follows: (1) Stuffiness is due primarily to stagnation of the air—to warmth, humidity and stillness; to utilize fully the restorative value of air, it should be sufficiently dry, in motion, reasonably low in temperature and possess adequate cooling power; (2) a CO_2 content as high as 1 per cent has no apparent detrimental effect on a person who is resting; it merely causes deeper breathing on the part of one who is engaged in muscular effort; (3) no evidence shows that exhaled air contains organic toxins; (4) general comfort is secured, waste products are removed more easily by respiratory channels, general health is improved and resistance to disease is strengthened if one lives and works in cool dry air in motion.

In this great problem of raising the efficiency of the human machine, by attention to details of atmospheric conditions, science has done its share—for the love of achievement. The evidence is incontrovertible; the logic of the conclusion reached is inescapable. And yet how far has industry benefited from the results of painstaking research and a determination to uncover fundamental truths of immense importance? Underground, in mines, where men work primarily with their hands, the subject has been forced upon the attention of executives because of the obvious fact that the output per man is increased if proper ventilation is provided. In office and factory much remains to be done. The brain worker who sits at his task year in and year out accepts a growing mental ennui as an inevitable sequel to the encroachment of time, whereas it is probably due to bad air and poor ventilation. It is neither economical nor scientific to attempt to remedy

a stagnant atmosphere indoors in winter time by opening windows, although this is usually the only method available to secure the movement of air that is essential to the efficient operation of the human machine. The increased efficiency of the worker whose atmospheric surroundings are satisfactory is incalculable. The cost of the scientific control of the conditions that have such a tremendous influence on the individual's quality and output would be met in large part by the economies resulting from a saving in fuel now being used for increased heating to counteract the chilling effect of outside air introduced as a palliative for the ill effects of stagnant atmosphere.

A New Plan For Muscle Shoals

IN THE absence of rumored additional offers for Muscle Shoals the proposal of Mr. Ford is still in the spot light. The latest consideration given to the manufacturer's plan is embodied in H.R. 3222 introduced in Congress on Dec. 13 by Mr. Dickinson of Iowa. The bill gives evidence of a very careful, deliberate and, in our judgment, successful attempt to modify the original Ford offer to meet the objections raised against the 100-year lease clause, the manufacture of nitrogen fertilizer throughout the lease period, and the low price of $5,000,000 offered by Mr. Ford for the nitrate plants, Waco quarry and Gorgas steam plant. The bill is immeasurably better than that of Mr. McKenzie or Senator Ladd, both of which contain the needless proposal to present Mr. Ford with a duplicate of the Gorgas plant. It is too early to say whether the Dickinson bill is wholly acceptable to the United States, but it forms a basis for negotiation that is distinctly better than anything yet proposed. Its principal features provide for a 50-year lease of Muscle Shoals Dam No. 2 and power plant under the terms of the federal water-power act at an annual rental of 6 per cent of the cost of the project; a 50-year lease of the nitrate plants and Waco quarry at an annual rental of $1; the production of at least 40,000 tons of fixed nitrogen annually throughout the lease period; and the sale and distribution of surplus power not used in the manufacture of fertilizer.

Since the Ford offer is certain to be the basis of much discussion during the next few months, it may serve a useful purpose to compare briefly its salient points with those of the Dickinson bill.

With respect to the power project, which was partly completed when Mr. Ford made his offer he proposed to complete Dam No. 2 and build a hydro-electric power plant of 600,000-hp. capacity and to lease this property for a period of 100 years at an annual rental of 4 per cent of the cost, excluding the amount already expended on the dam, amounting to about $16,000,000. The lease was to date from the completion of the power plant to a point where 100,000 hp. was ready for service, and the rental for the first 6 years was to be a fixed sum of $200,000 per annum.

In the Dickinson bill the Ford offer is materially amended. Since Mr. Ford made his proposal substantial progress has been made by the United States in the construction of Dam No. 2, the investment now being between $25,000,000 and $26,000,000. The amount yet to be expended is estimated at from $15,000,000 to $18,000,000. The Dickinson bill proposes that the United States shall complete Dam No. 2 and build and equip a powerhouse of 600,000-hp. capacity and lease the same to Mr. Ford for a period of 50 years from the date when 100,000 hp. is ready for service. The proposed rate of interest is 6 per cent of the actual cost of the project, except that for the first 6 years of the lease fixed annual rentals shall be paid—$200,000 for the first year and $500,000 annually for each of the next 5 years. A proviso is inserted to the effect that the annual rental shall be reduced to 3 per cent to the extent that power generated is actually used in fertilizer production. This is at once a subsidy to nitrogen fixation and not less favorable to the government than the original offer, for if all the power should be used for nitrogen fixation, a 3 per cent rate on the total investment would be approximately equal to 4 per cent on the amount originally required to complete the dam.

With respect to the nitrate plants, it will be recalled that Mr. Ford offered to purchase No. 1 and No. 2, together with the Waco quarry and the Gorgas steam power plant on the Warrior River, for the nominal sum of $5,000,000. The only attractive feature of this offer was that Mr. Ford proposed to maintain plant No. 2 in its present state of readiness for the manufacture of explosives in time of war. Otherwise there was little to commend it except the prospect of developing nitrogen fixation in this country and producing cheap fertilizer for the farmers.

On the theory that Mr. Ford can make fertilizer quite as well if he leases rather than buys the nitrate plants, the Dickinson bill proposes to lease plants Nos. 1 and 2 and the Waco quarry for a nominal rental of $1 a year. Under the terms of the bill it would still be incumbent upon Mr. Ford to maintain plant No. 2 in its present state of readiness for immediate operation in the manufacture of war explosives. The Gorgas steam plant having been sold to the Alabama Power Co., the Dickinson bill gives it no consideration.

There are minor changes in the wording of other clauses of the original Ford offer, clarifying their purpose and intent and safeguarding the interests of the United States as well as those of the lessee.

Until other offers for Muscle Shoals materialize, all that can be said of the Dickinson bill is that it offers a new and better basis for negotiations. New points of controversy can be foreseen, particularly in the obvious subsidy to fertilizer production. In this respect the bill is more favorable to Mr. Ford than is his own offer. On the other hand, there is a great deal of merit in removing from the field of controversy the nominal price of $5,000,000 offered for a property that cost more than $100,000,000 and in bringing the lease of the water-power project fully within the terms of the federal water-power act. The Dickinson bill should be less controversial than those of Mr. McKenzie and Senator Ladd. The latter impose new obligations on the United States, while the former retains federal title to the properties and leases them on generous terms.

Whether the amendments will appeal to Mr. Ford remains to be seen. They offer a challenge to his willingness to negotiate for the property on terms other than his own. If no better offer is brought to light and Mr. Ford is willing to negotiate on the basis of the Dickinson bill, he should receive favorable consideration. If, on the other hand, he stands obstinately for his original terms, he should be eliminated as a prospective lessee or purchaser.

A Revolution in the Power Field

Recent Successful Tests on a Binary Vapor Boiler and Turbine Point the Way to Great Future Economies in Power Generation

BECAUSE mercury boils at 677 deg. F. and water at 212 deg. F. when the pressure is atmospheric, inventors have long sought to combine the two liquids in a boiler-generator system. To make two blades of grass grow where but one grew before, to make one B.t.u. do the work formerly done by two B.t.u., this has been the dream of many inventors these hundred years past. But it has remained for W. L. H. Emmet, consulting engineer of the General Electric Co., to invent a successful process in which mercury and water are vaporized and their vapors used in power generation.

Two such boilers have been built to date, an experimental apparatus operated at the Schenectady works of the General Electric Co. and an experimental installation now under observation at the Dutch Point generating station of the Hartford Electric Light Co., at Hartford, Conn.

This installation is the first of its kind in the world. Experiments have been conducted by the General Electric Co. over a period of several years. The success of these experiments warranted the manufacture of a set of commercial size and it was arranged between the two companies that this installation should be made in Hartford. The equipment at Hartford is now being operated with a partial load for the purpose of getting experience with continued running without risk of injury through overloading.

The rising cost of coal and its transportation makes it more and more desirable to reduce to a minimum the fuel consumption for the manufacture of power. Any substantial savings warrant a very large investment in power station equipment and the expenditure of considerable sums of money in devising methods of operation with better fuel economy.

Mr. Emmet estimates that if the mercury boiler comes up to all expectations, it will produce with 35 lb. gage pressure, when compared with a steam turbine generating plant which uses 200 lb. steam pressure, about 52 per cent more output in electricity per pound of fuel.

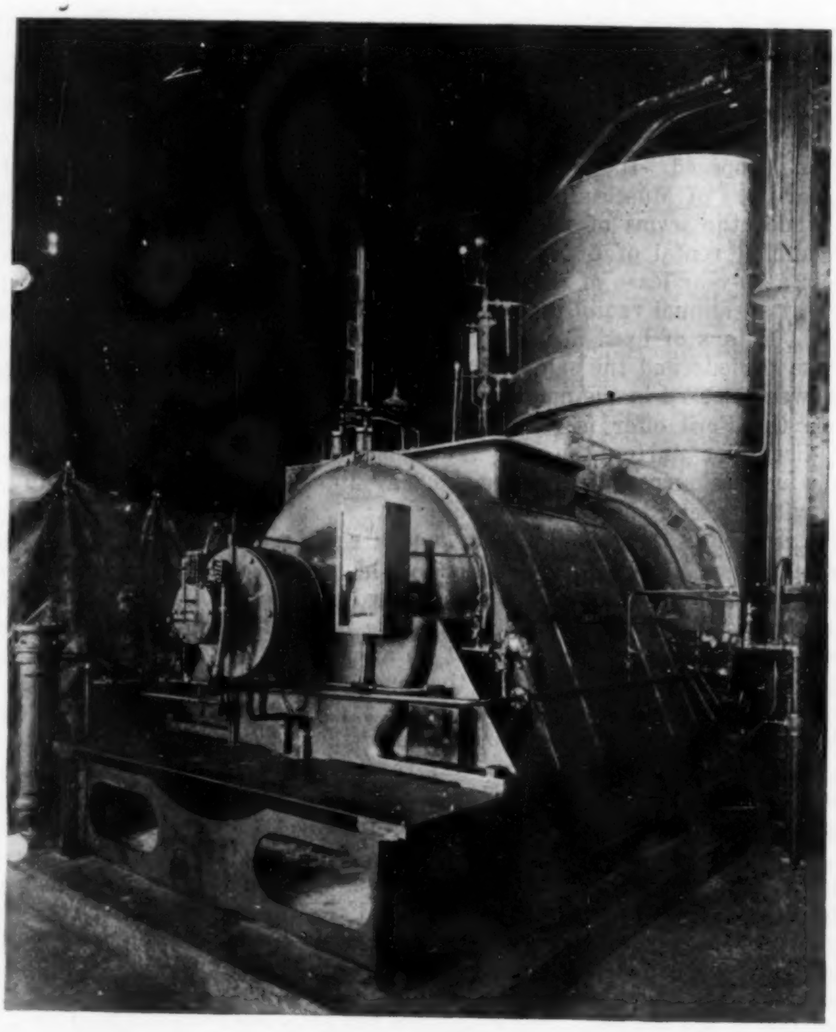
"And if," Mr. Emmet adds, "in such a plant the boiler room is re-equipped with furnaces and mercury apparatus arranged to burn 18 per cent more fuel, the station capacity, with the same steam turbines, condensers, auxiliaries, water circulation, etc., would be increased about 80 per cent."

The process is novel in every particular, and it was necessary to study most thoroughly the characteristics of mercury and its vapor. During the earlier experiments it was found that no form of packing or calking of the joints would resist the mercury vapor, and it is the development of arc and acetylene welding that has made such apparatus possible.

It was necessary for the inventor not only to design and manufacture the apparatus but also to devise methods of operation, as there was naturally no precedent by which to work. The apparatus was shipped and erected and was started and successfully operated just as designed.

The mercury vapor process involves the vaporization of mercury in a boiler, driving of a turbine by the mercury vapor and the condensation of the exhaust in a condenser where its latent heat is delivered to water and thus used to generate steam at pressure suitable for use in existing steam plants.

The condensed mercury runs back by gravity into the mercury boiler. Thus the mercury vapor acts as a heat conveyor and at the same time delivers energy to the mercury turbine. This affords a means by which the temperature range of operation is more than doubled as compared with ordinary steam processes, and the efficiency consequently greatly increased. Means are also provided by which the flue gases are brought to temperatures equivalent to those used in steam processes by being carried through a steam superheater and a feed water heater.



An application of this process on a large scale was built as Schenectady and operated experimentally on many occasions. This equipment was originally designed to give 1,500 kw. from the mercury turbine, but it was never run above 1,050 kw. Of the 1,050 kw. so delivered in these tests, 800 constitutes net gain as compared with a 200-lb. steam process operating with similar firing conditions. With such a performance of the mercury turbine and with the steam produced used as in the best power stations, this result is equivalent to about 11,300 B.t.u. from fuel per kilowatt-hour; 18,000 B.t.u. per kilowatt hour is considered extremely good in large existing steam stations. This equipment operated with about 12 lb. pressure in the mercury boiler. "By using a pressure of 35 lb., which seems to be possible," Mr. Emmet says, "the efficiency could be considerably increased."

The present installation is not of sufficient capacity to have much effect on the total cost of power produced by the electric company at the present time. It is large enough, however, so that much should be learned about the results that may be expected when used on a large scale. This initial success indicates that there is no insurmountable obstacle to manufacture sets of a size to replace the large steam boilers now installed in modern power stations.

The last great step of several years ago in improving the efficiency of manufacturing power was the replacement of the reciprocating engine by the steam turbine.

The modern steam turbine under similar conditions is about 40 per cent more efficient than the best reciprocating engines, and the attainment of this degree of gain has been the work of 20 years. "It would seem," Mr. Emmet says, "that the introduction of the mercury process would accomplish a much greater gain. And this may be greatly increased because it is believed possible to make mercury turbines much better than those which have been tested and also to use higher pressures in the mercury vapor."

The change from reciprocating engines to steam turbines necessitated complete redesign of the old station. But in applying the mercury process it is necessary only to replace the steam boiler in the large modern plants by a mercury boiler, which will give greatly increased output in the same space. In other words, there will be no general redesign of a station to obtain the benefit of the better economy and at the same time materially increase the output from the building. Like all great steps in advance, time will be required to develop and perfect a system before this process can be expected to reflect on the operating costs of the public utilities.

Naturally, the question that will arise in connection with this mercury process is the danger from mercurial poisoning, either to the community or to the attendants. In the first place, as previously stated, all joints are welded, so that it is impossible for mercury to escape except through accident, and arrangements are such that leakage, if it should occur, will go into the stack, where it can do no harm.

Mercury boils and condenses much like water, except that its density is much greater and its boiling temperature much higher. At atmospheric pressure mercury boils at 677 deg. F. and water at 212 deg. Mercury condenses in a 28-in. vacuum at 455 deg. F. and water at 100 deg.

At present mercury sells for about 80 cents a pound. The boiler installed in Hartford contains 30,000 lb. of mercury, and is designed to give from mercury and steam about 4,100 kw., giving about 7.3 lb. of mercury per kilowatt. Recent experiments indicate that in future designs 4 lb. per kilowatt will be sufficient.

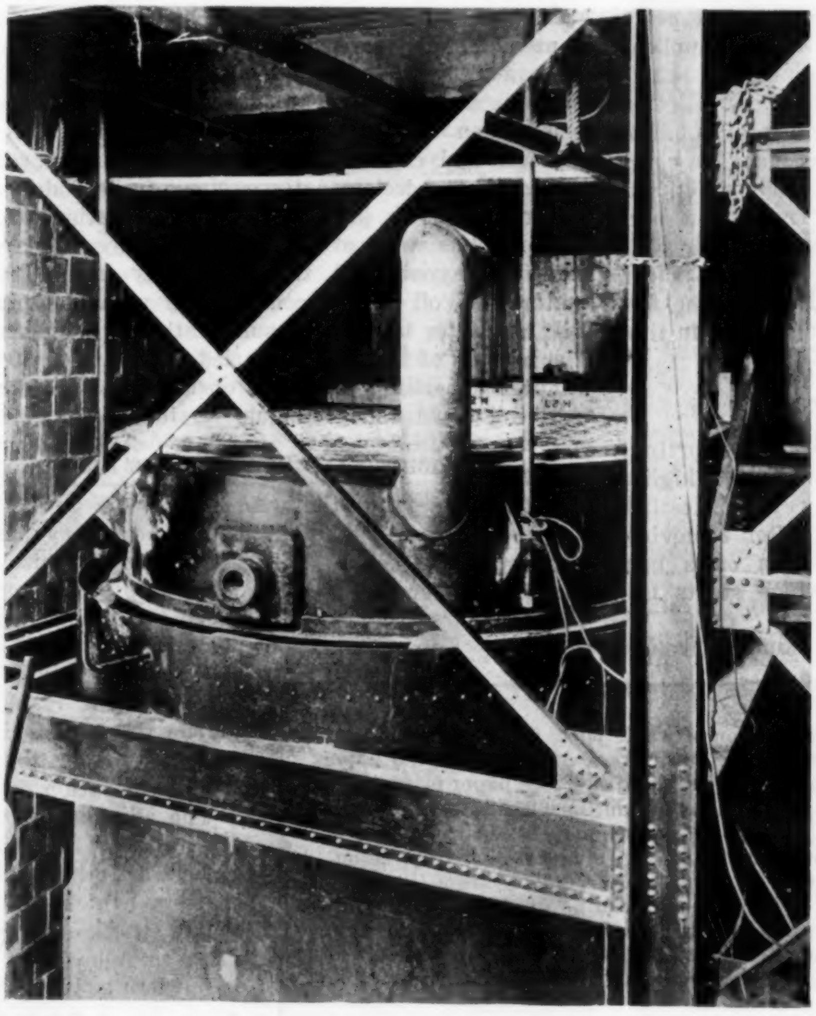
Mr. Emmet, inventor of the mercury vapor process, has had an important part in the designing of electrical apparatus for the General Electric Co. and in the development of its uses from the time of the company's formation.

He was responsible for the development of the Curtis turbine and the promotion and direction of the company's steam turbine activities for many years. Mr. Emmet has also been the father of electric ship propulsion and has promoted and very largely designed the very large applications of it which have been made in the U. S. Navy and elsewhere.

Mr. Emmet has been elected a member of the National Academy of Sciences and the American Philosophical Society. He was awarded the Edison Medal in 1919, and other medals and degrees. He is a graduate of the U. S. Naval Academy and is a member of several engineering societies.

The New Mercury Boiler

On page opposite is shown the condenser and the generator of the Mercury Vapor Process unit. On this page is shown a mercury boiler suspended over furnace, both installed at the Hartford Electric Light Co., Hartford, Conn.



Use of De-inked Stock in
Production of Book Paper

Outline of Steps Followed in the Plant of the Newton Falls Paper Co., Where the Product Is Softened by the Addition of De-inked Paper Stock to Sulphite Pulp

BY HAROLD J. PAYNE
Of the Editorial Staff of *Chem. & Met.*

BOOK PAPER is the term given in general to paper of all grades and varieties capable of use in printing. The stock upon which this magazine is printed is such a paper, made in this case at the plant of the Newton Falls Paper Co. from sulphite pulp mixed with de-inked stock. The production and bleaching of its sulphite pulp content have been described in previous issues of *Chem. & Met.* (vol. 29, No. 19, p. 831, vol. 29, No. 22, p. 959). Here the treatment of waste paper in taking out the ink and in re-pulping, the actual paper-making process and the recovery of waste fiber are discussed. While the practice involved is not unusual, still it is rich in applications of unit processes of chemical engineering.

This paper may contain a variety of fibers. Better grades are commonly made from a mixture of sulphite and soda pulps. Market conditions are such, however, that the soda constituent may face keen competition with de-inked stock or pulp recovered from old paper. Provided de-inked stock be made under favorable conditions, such competition may become keen. A short haul from raw supply markets as well as for the finished product is very nearly a controlling factor in this connection.

The De-inking Process

The reworking of old paper begins with sorting, which is necessary to remove groundwood and highly colored papers. The sorters work by hand testing doubtful samples with phloroglucinol. After removing all undesirable material the paper is run on a belt conveyor into a shredder or cutter, which starts the process of disintegration.

Dust is removed by fans in a special chamber through which the stock passes to the boilers. In this chamber solid particles are fanned out (a solids-from-gas separation). Four boilers are used in cooking the dusted paper, each roughly 11 ft. in diameter by 14 ft. high. One of these is being filled constantly while two are cooking, the fourth remaining as a spare.

The main de-inking process is a cook at boiling temperature for about half an hour. Usually 7 per cent of the weight of dry paper is added in soda ash and the mass brought up to a boil (1 ton to a batch). Cold water is used at the start, heating with steam. Action of the soda combined with agitation by a three-arm wooden stirrer causes considerable disintegration. Strenuous treatment is still required to loosen the ink, however, and for this purpose a covered beater is used, built essentially as that shown in Fig. 2. This is a large tub-shaped machine with a heavy roll rotating in a channel on one side. This roll is provided with bars of metal running lengthwise across the face as the teeth on a gear. These bars beat or rub the pulp as it passes underneath over a metal "bed plate." The action is such as to disintegrate the pulp, to change its physical and chemical properties accordingly. Steam is run in to accelerate the action of the soda ash on the ink. This is in a sense a saponification. As far as the oil content of the ink originally employed in printing is concerned, this is entirely true. It is by taking this oil out of combination with the pigment that the latter is loosened sufficiently to be washed out. The process of beating is carried on for from 30 to 60 minutes depending upon the obstinacy of the fiber in breaking down and giving up its ink.

Washing and Refining the Pulp

Before beginning the washing a riffle and a short screen are used to take out metallic and heavy foreign matter and to eliminate useless and oversize fiber bundles. After this treatment the pulp passes to three Wolf washers of the rotary screen type, which operate in series. Large amounts of river water are added and eliminated at each washing, with the result that at the third washer very little of the original ink and discoloration remains.

The alkaline process of cooking combined with the traces of other coloring matters which remain makes it essential, however, to follow this process with a bleaching if stock for a white paper is to be obtained.

The utilization of waste material in every industry becomes daily a more pressing issue. In the paper field, about 1,000,000 tons of waste paper is available annually, capable of producing 900,000 tons or more of new paper. The technique of this reworking or de-inking, while relatively simple as here carried out, is far from perfected. Nevertheless, from the better grades of paper a pulp can be produced very nearly as satisfactory for manufacture as new soda pulp. This story tells how this is done and more—the chemical engineering in actual paper production and in fiber conservation.

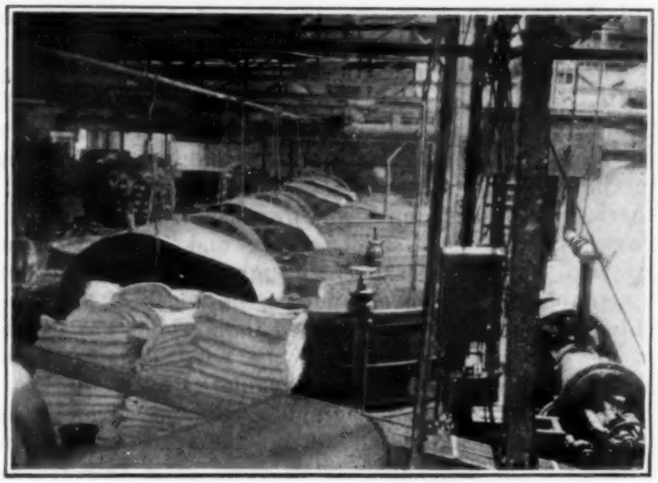


Fig. 1—Beater Room With Jordan on Right

From the third washer the stock drops to a chest into which bleach is added every time a beater is dumped. This process of bleaching is therefore continuous. A large agitator keeps the stock well mixed at this point. Approximately 8.5 lb. of chlorine (1 to 1.2 per cent of the weight of paper expressed in terms of bleaching powder carrying 35 per cent available chlorine) is added here for every ton of pulp treated. The bleach is of course added in liquid form; the operation is carried out at a consistency of about 2 per cent fiber and is continuous.

To remove shives, bundles of paper and any foreign material still remaining and also to insure uniformity of the pulp, another riffle and a set of two screens are employed. The pulp then goes to a fourth washer, which in this case, although identical in construction with the three previous washers, is called a thickener. The delivery from the thickener is direct to the stock chest from which the paper mill beaters are supplied with de-inked stock. In case more de-inked stock is being produced than is wanted directly there, it is made into laps on a wet machine in exactly the same manner as the sulphite pulp.

In the entire process about 30 per cent of the original weight of the paper is lost, approximately half of this shrinkage being due to the removal of clay and ink. The fiber, while shorter, softer and slightly more difficult to make into paper than new sulphite fiber, makes

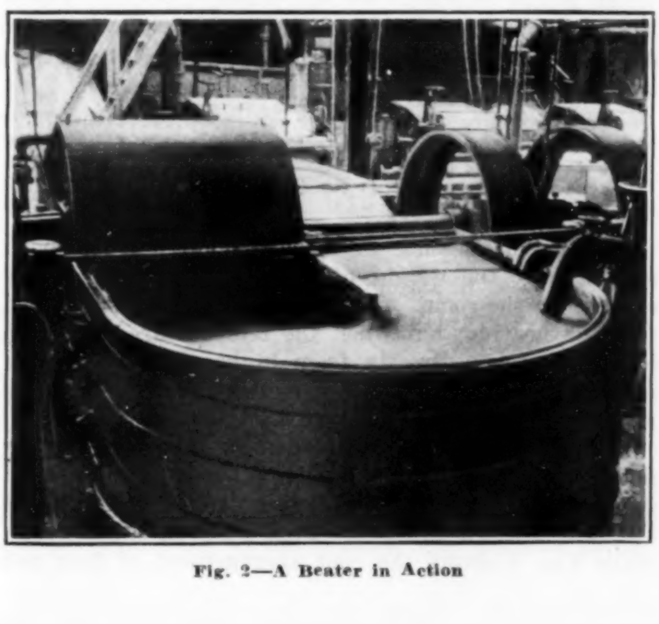


Fig. 2—A Beater in Action

a very satisfactory sheet and can be used with success without any other fiber in making a book paper if it is desired to do so. At this mill, however, it is not ordinary practice to use more than 20 per cent of de-inked stock in book paper, while none is used in bond and ledger. With the apparatus described about 18 tons of de-inked fiber is being produced per 12-hour day. Approximately 10 gal. of water per minute of the working day per ton is used, while the power consumption, aside from the low-pressure steam used for heating, averages 150 hp. over the operating period, or 150 hp. $\times$ 12 hours $\div$ 18 tons, or 100 hp.-hr. per ton of recovered pulp. The man-hours per ton of pulp produced averages 6.

Pulp Production Ends; Paper Begins

Here the story of pulp ends, that of paper, as such, begins. Previously, in our story of the sulphite process, the curtain fell at this point. We are now ready to trace the bleached pulp into the finished sheet. The next step in this process is conducted in the beater room shown in Fig. 1.

This is considered the heart of the mill. Depending on the treatment given the pulp in the beaters a good

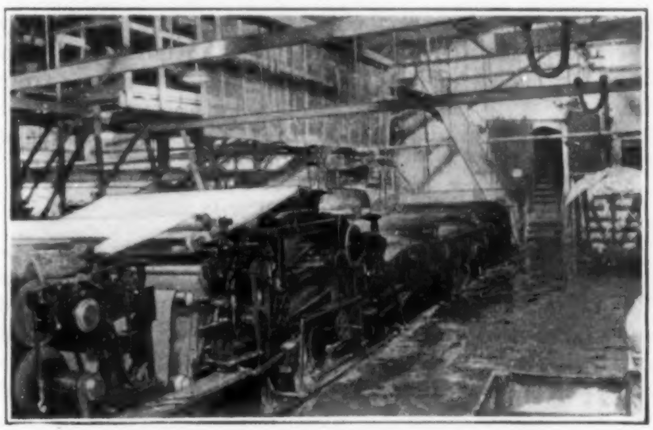


Fig. 3—Fourdrinier Forming the Paper

or bad sheet will be produced. Here the cellulose, in 1,800 to 2,250 lb. batches, is hydrated both physically and chemically by the mechanical rubbing and shearing action of the beater roll. It is by the combined disintegration and swelling due to this action that the pulp is rendered into a form suitable for "felting" or forming a satisfactory sheet on the paper machine. Because of the intimate mixing that takes place in the beater, this is the meeting point for the various materials in addition to the cellulose fiber which go into the product.

At Newton Falls, for a book paper, de-inked and sulphite pulp meet here. Since de-inked stock has been beaten previously, in a former trip through the mill, this is added last to avoid carrying the disintegration too far. Clay in the form of a previously mixed solution is added for a filler to make a smooth opaque sheet which will readily take ink when it goes through the print shop. A size solution of sodium resinate is added to improve further the surface of the sheet. Talc is frequently incorporated with this size solution before addition, since it is a very good filler and cannot be added alone. Alum is added to acidify slightly further to insure the retention of these materials. Wherever possible these substances are added to the

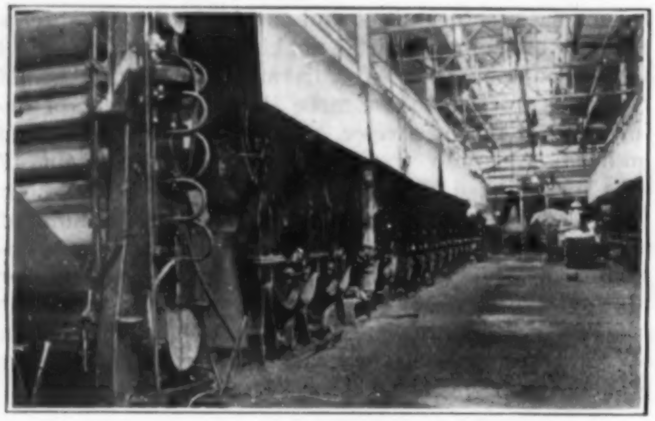


Fig. 4—Drying Rolls With Calender on Left

beaters in gelatinous form, since this practice has been found to give better results than other methods. To obtain a clear white pulp blue dye is frequently found necessary for offsetting the yellowish cast imparted by river water.

Before passing to the machine chest the fiber passes through a jordan. Here the disintegration of the fiber bundles is completed and the length of the individual fibers regulated. Having passed through this machine, actually a mechanical shearer, the paper stock is ready for the last stage of manufacture—forming and drying. To insure uniformity of the pulp as it passes from the beaters to the paper machines, the machine chest in which successive beater loads are stored is fitted with a paddle agitator.

The Machine Room

There are two paper machines at this mill, one turning out a trimmed sheet 101 in. wide, the other an 81-in. sheet. The chemical engineering involved directly in this room has mainly to do with the drying of the paper once it has been formed on the fourdrinier wire shown in Fig. 3. These machines run at a speed of approximately 350 ft. per minute on book paper. While this speed is relatively low as compared with large newsprint machines, still it is obvious that evaporation is very rapid with the sheet, as it goes onto the drying rolls carrying 95 per cent of moisture and not over 10 per cent as it comes off at the dry end (shown in Fig. 4). The problem of air conditioning enters strongly here if economy of heat is to be realized.

Fig. 5—Press Rolls Carrying the Wet Paper

These paper machines in themselves, if considered as units, despite the fact that they actually consist of many interdependent parts, carry out three distinct chemical engineering processes, mechanical separation, mixing and agitating and drying. At the feed end there is a Bird machine, an inward flow rotary screen device, taking out small shives and other foreign material. After passing through the headbox, the acceptable fiber is spread out to the width of the machine by a wooden trough called the apron. The depth of the solution, flowing onto the wire, dependent on the paper being produced, is regulated by a slice bar or a sort of dam, extending across the apron at a variable distance above it. From the apron and under this slice the pulp suspension flows at a rate corresponding to the speed of the machine onto the fourdrinier, where the sheet is "formed." Here the water is drawn out of the suspended fiber, forming a paper pulp felt on the wire. The removal of this water, a sort of rapid filtration, is assisted by crosswise agitation and by suction rolls supporting the wire. This part of the machine is shown clearly at the right of Fig. 3.

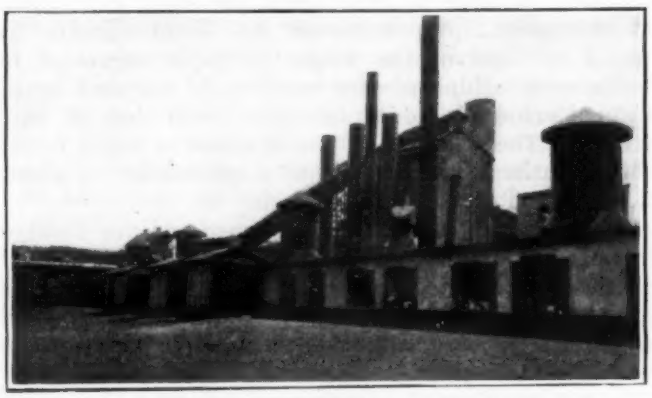


Fig. 6—Hoods and Stocks Above Machines

Water Balance on Driers

The wet paper felt or web is carried between three sets of press rolls (Fig. 5), which take out a part of the moisture mechanically. Then comes the business of drying. On these machines there are twenty-six rotary drum driers to evaporate the water from the paper. The following table shows approximately what the moisture balance on the machine actually is:

Per cent moisture onto wire	96.00
Per cent moisture off fourdrinier screen	79.00
Per cent moisture off Press No. 1	70.00
Per cent moisture off Press No. 2	63.40
Per cent moisture off Press No. 3	61.40
Per cent moisture off dry end	5.10

The steam pressure in these drying rolls is varied according to the weight of sheet and to the humidity existing in the room. Ordinarily exhaust steam is used for this heating, but when the temperature drops too low, live steam directly from higher pressure mains is available. The adjustments are such that the pressure in each roll may be regulated separately.

For taking the moisture-laden air above the paper machines out of the room a large hood built of wood has been placed over each drying section according to the best modern practice. Fig. 4 shows these hoods, while Fig. 6 shows the roof arrangement of fans and

ventilator stacks to take care of the circulation in the machine room. The object is to carry out air just below the saturation point at the lowest possible temperature. One of the constant winter troubles in the machine room of the paper mill is the condensing of the warm moist air coming in contact with the cold roof.

The rated capacity of the two machines working on book paper weighing 50 lb. per ream of 500 sheets 25x38 in. is approximately 45 tons per day. The machines are fixed in speed and in order to change must be shut down. Each is equipped with a double stack calender, a heavy press roll device for imparting a hard, smooth finish to the sheet.

The book paper before leaving the mill is run through another very heavy or super-calender stack (Fig. 7) in two directions in order to put a high finish on both sides. The remainder of the finishing process as it is is carried out here is relatively simple. The calendered rolls are run over cutters which clip off and pile sheets large enough to print sixteen pages the size of this one at a time—that is, four times this length and width.

All of the waste paper resulting in the manufacture, including the trim, is saved. It is conveyed by large carts (broke carts) to a "pulper," which macerates the paper. Hot water is added to aid in this mechanical disintegration. The resulting waste paper pulp is worked back into production in the beaters. Thus it is seen that there is no fiber loss from the beaters to the finishing room except in the form of white water —that is, water carrying a fiber suspension, which may escape from the process.

White Water Control—The Save-all System

Water is the natural conveying medium for paper-making fibers throughout the process of fabrication. When the fibers in the water are in low concentration, as in the suction boxes under the fourdrinier wire, it is spoken of in the mill as white water. To recover the fibers contained in these dilute solutions constitutes a conservation problem of first importance to the industry. A considerable amount of work has been done in devising methods whereby the fiber might be taken out economically and the mill effluent might be clean. The saving in good operation against poor operation at this point represents close to 20 per cent of the original fiber.

Several fairly successful systems of recovery have been worked out, each with its own special adaptability. At Newton Falls the major part of the work is done in the conical save-alls shown in Fig. 8. These specially constructed cement tanks carry out the last step of recovery of the fiber which escapes as white water in earlier stages of the process.

When the paper pulp mixture out of which the sheet is made is flowed from the Bird machine onto the felting wire or fourdrinier where the sheet is formed, it carries about 96 per cent of water. The suction boxes under this wire, as well as the motion of the wire, tend to draw much of this water out of the felted sheet. As this operation is carried out many short fibers escape along with the water. This is all caught in trays under the moving wire and conducted to a mixing box, where it is thoroughly agitated before being passed back to the rotary screen of the Bird machine to aid in dilution of the fiber coming up from the machine chest. Here the bulk of the largest fibers is taken out and passed directly on to the wire of the machine again. The white water which passes through this Bird screen drops to a pit, whence it is pumped to a so-called improved save-all, which, like the previous rotary screen of the Bird machine, operates on the principles of wet screening by means of natural suction. The concentration of solids in the entering suspension here is around 0.3 per cent. All of the good fiber taken out here goes back to the machine chest, concentrated up to about 4 per cent solids, to be mixed with the fiber dropped from the jordans. Very little of the clay is taken out, since most of this goes through to the Lindsay type conical save-alls at the end of the system, each designed to handle approximately 400 gal. per minute.

The suspension from the improved save-all, while carrying only a small percentage of fiber (roughly, 0.17 per cent solids, of which 72 per cent is clay), is large in volume (500,000 to 700,000 gal. per machine in 24 hours). This flows into a pit, where a small amount of special coagulent is constantly added by a motor-driven feeding device, the better to insure complete

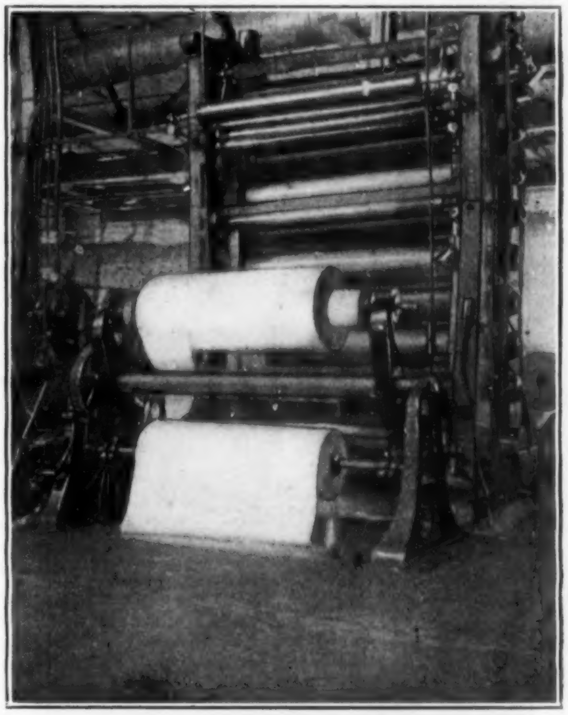


Fig. 7—Super-Calender Finishing the Paper

"solids-from-liquids" separation. From here the fiber passes to the top of the conical save-alls previously mentioned. It is fed into these tanks, 20 ft. in diameter, which hold upward of 30,000 gal., by a trough providing uniform inflow, which runs around the top of the entire circumference. This, as well as the outlet, is shown clearly in Fig. 9. About 8 in. inside the cement wall and extending about two-thirds of the way down, a steel cylinder is hung. The inflowing white water (carrying about 1.4 grams per liter) drops in a slow flow between these two walls. The fiber settling out sinks into the conical receiver at the bottom (the concentration there building up to about 9 g.p.l.), whence it is pumped either to wet machines or back to the mixing box and from there by the regular route to the machine. The overflow rises through the inside of the suspended cylinder and is taken off at the top and pumped to a storage tank which is used to supply the beaters with water when a furnish is being made up. The overflow from this water-storage tank flows to the

river and the fiber contained in it represents practically the only loss entailed in the process from start to finish. Its actual fiber content is very low, however, and represents practically nothing of value in fabrication. If it were not for this outlet, the water circulation system of the paper mill would be entirely closed.

Power in the Mill

Facilities at Newton Falls are so arranged that water power and motors may be used interchangeably on a considerable amount of the apparatus. The wood room and beater room may be operated entirely by this means for the greater part of the year. Theoretically the water-power installation should turn out about 1,400 hp., but actually it is producing less than half of this. For use in time when the water is low or for other reasons unavailable, motors may be used by a shift of belts except on five of the beaters, which are so arranged as to run on water power only. The jordans are run entirely by motors, while the paper machines are operated by steam engines.

Besides the waste fuel-burning boiler which is used merely to produce process steam, there is a modern installation of two automatically stoked Sterling boilers which carry the load of the plant. These boilers are rated at 612 hp. per unit, with an overload rating of 150 per cent. Actually they have given excellent results when carrying 200 per cent overload. A test made when one machine was down and in winter showed the following disposition of steam in the plant over a period of 24 hours:

Fig. 8—Conical Save-all System

	Lb.
Bleachery	14,781
Calenders	169,575
Digesters	265,200
Acid plant	2,340
Heating	252,992
Soot fan, ash blowers and turbines, approx.	144,000
Balance mainly on paper machine driers	427,910

One very interesting feature of arrangements made for power at Newton Falls is the automatically controlled auxiliary generating station about a mile down the river from the plant. This machine is rated at 1,400 kva. and is shown in Fig. 10. Ordinarily a small load is carried on it. But when a peak occurs at the plant, the gates are opened by an operator a mile away and the machine speeds up. In this way what would ordinarily cause a heavy overload on the mains from which the plant derives most of its wattage is done away with.

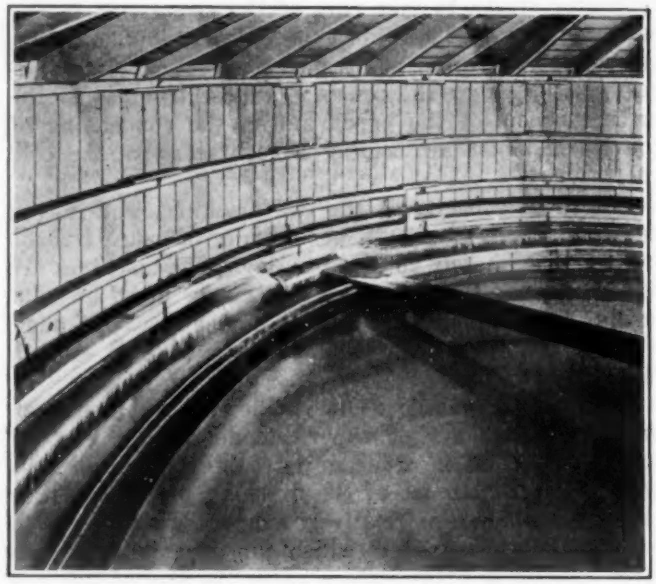


Fig. 9—Inside Save-all Showing Means of Flow

This ends the story of book paper making at Newton Falls. A brief glimpse has been given of one small part of an industry which is fundamentally chemically engineering in the nature of its problems and processes. Here and there difficulties have been pointed out, which must be solved before fully efficient production may be achieved. The field of development has been but scratched—many of the most pressing problems of pulp production are now met but half way. Upon the shoulders of the technical and production men in the industry rests a tremendous task. More power to those who carry on!

Opportunity is here taken to acknowledge and express appreciation of assistance rendered in the preparation of this account. Included in this list to whom the author is indebted are A. J. Baldwin, president, and Robert Gregor, superintendent of the Newton Falls Paper Co., W. M. Osborne and staff of the chemical laboratory at the plant, Messrs. Alexief and Osborne of the mechanical department; O. L. Berger, engineer of the Jennsen Co., and Robert Wolf, who played a large part in laying out and building the plant.

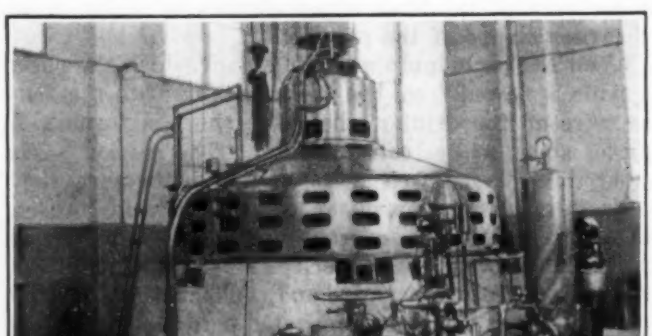


Fig. 10—Automatically Controlled Generator

How to Get the Most Out of
Electric Furnace Refractories

Practical Suggestions for the Construction of Lining Walls, Hearths and Roofs That Will Enable the Electric Furnace Operator to Obtain Maximum Refractory Service

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LONG life for the refractory linings of electric furnaces is largely dependent upon two factors: (1) selection of the most suitable type of refractory for the particular operation or process and (2) proper setting of the brick.

As indicated in the accompanying table, a large number of refractory materials are available in the form of powder, grains, cements, lumps, brick of standard shape and size or special shapes. The applicability in any specific instance should be determined by consideration of such properties as: the softening temperature under load, chemical character, porosity, density, and susceptibility to temperature fluctuations. However, as these points have been frequently discussed and are generally recognized, it is my intention to dismiss them with this brief mention in order to place more emphasis upon the second factor. Experience has convinced me that proper attention to details in setting linings is of utmost importance in obtaining maximum service, and in the following discussion I have endeavored to present practical suggestions on the construction of lining walls, hearths and roofs.

SETTING LINING WALLS

In order to maintain an even pressure on the brick, the surfaces of the brick must be flat, free from warp and swell, hollows and bumps. By securing the uniform bearing of one surface on another cracking may be prevented. Most brick as they come from the manufacturer possess surface irregularities, many of which are uncontrollable in the process of manufacture. All refractories are subjected to loaded heating. By this is meant that they are subjected not alone to high temperatures but in addition must carry the dead weight load of the structure. As an appreciation of this, furnace builders have so designed their furnaces that no extra load is placed on the lining walls. Although in early types of furnaces the roofs set directly on the lining walls, this is now being eliminated by setting and fastening the roof to the shell. Loaded heating, then, requires not only the maximum refractoriness of the material but perfection in the dimensional characteristics of the brick as well.

When brick surfaces are not flat and even, they may be made so by rubbing on an abrasive surface. Softer brick such as fireclay may be rubbed against one another. Harder brick as magnesia, chrome silica and zircon may be rubbed down by applying to a grinding surface. The amount of truing up necessary may be quickly determined by placing together two bricks one in each hand and observing whether they "roll" or "rock" on each other. This may appear to some to be a needless waste of a bricklayer's time, but the momentary inspection may mean a great deal to the life of the setting.

In further appreciation of the necessity for perfect brick-to-brick contacts, I quote from a prominent brick manufacturer's catalog: "Dip brick and rub to make a brick-to-brick joint." It is this manufacturer's purpose to obtain the perfect contact necessary, by filling the irregularities in the brick surface with a thin wash of water-clay emulsion. But in many brick that I have examined over a number of years, no amount of emulsion will rectify the irregular and uneven surfaces. Grinding of the surface is essential and necessary.

Classification of Refractory Materials

Acid		Neutral		Basic	
Silica sand.....	P	Bauxite........	B	Magnesia.......	B,G,P
Quartz........	B,P	Chrome ore....	B,P	Lime...........	G,P
Ganister.......	G	Zirconia.......	B,P	Dolomite.......	G
Quartzite......	B,G,P	Zircon.........	B,P	Magnefer.......	G
Fire clays.....	B,P	Carborundum..	B,P	Syndolag.......	G
Flintclays	P	Carbofrax.....	B	Magnesia ferrite	G
Granites.......	B	Alundum......	P,G	Durox..........	B,G
Schists........	G	Silundum......	..	Diamel.........	B,G
Mica..........	P	Alumina.......	P	Furnite.........	G,P
Gneiss........	B	Diaspore clays	B		
		Sillimanite.....	G,P		
		Spinel minerals	B		
		Corundum.....	G,P		

The letters B, G, P indicate that the materials are obtainable in the form of standard brick, grains or fine powder, respectively.

A very slight amount of bonding materials between the brick surfaces may at times be most beneficial, as it serves to close surface pores. But one of the bad effects of irregular brick is that the workman fills up these surface irregularities with wet or dry materials, and then expects the structure to be stable. Where two surfaces are in intimate contact, very little material will be retained in the joint. And where the surfaces are not in intimate contact, the material used as filler or bond does not support the structure when it shifts and readjusts itself to temperature and expansion changes.

Flat, evenly bearing surfaces are prerequisite in refractory setting. Even expansion, even contraction and even pressure are all attained by getting the surfaces bearing at the time the setting is put up.

CLOSED TIGHT JOINTS ARE ESSENTIAL

Refractories used for high-temperature work are generally exposed to the action of highly heated gases, vapors, liquid slags and metals. These impinge with varying force upon the surfaces and initial penetration into the refractory setting usually takes place along

the lines of least resistance—the joints between the bricks.

Consider the construction of furnace side walls with the bricks set as stretchers or as headers. A standard brick set as a stretcher exposes an area of 2½x9 in., or 22½ sq.in. If the joints at each end are not tight, an additional 22½ sq.in. is open to attack, making a total of 45 sq.in. Set as a header, a brick exposes a surface of 2½x4½ in., or 11¼ sq.in., and if the end joints are open, an additional 45 sq.in., or a total of 56¼ sq.in. These calculations do not take into account the possibility of poor contacts in horizontal joints, as this point has already been emphasized in detail.

When a new lining or setting is placed in service, the material composing it is in its original manufactured state and it should be remembered that data on the properties of refractories refer only to this condition. When the furnace has been operated for a number of heats, the material undergoes a marked change.

Are you satisfied with the service which your electric furnace refractories are giving? If not, don't jump at once to the conclusion that the manufacturer is at fault, but study this article carefully and see if you have not, perhaps unwittingly, neglected many of the details which Mr. Gosrow has found through long experience to be essential for long life of settings.

Under the combined action of heat and pressure, changes of structure and of volume occur; solids and vapors are absorbed, the specific gravity usually increasing. The pores of the refractory become partly filled with metallic and earthy sublimates, slag and metal. The surface layers, of course, take up these materials more quickly, and the effect is here more pronounced. But the action gradually penetrates through the body of the refractory, thereby materially altering the original properties, such as the softening temperature under load, which is lowered very considerably. As the rate of penetration is not the same for all refractories, there is wide variation in the ability to resist such deterioration.

To take an ideal condition, if the porosity of a brick could be reduced to a minimum and the area of attack or exposure similarly diminished, we should then have a material that would be subject only to fusion and not be altered in composition by the action of furnace products. The writer has a method whereby the porosity may be decreased, although the final details have not as yet been perfected. The area of exposure may be reduced to a minimum by making sure that all joints are closed tight and by allowing only the actual working surface to come in contact with the furnace products.

In connection with this appeal for obtaining closed tight joints, it is pertinent to mention the use of cements and powders manufactured and sold for this purpose by refractory manufacturers. I have this comment to make, that most of these cements and powders are used in too great amount. It is not essential to cement a brick setting, as a whole, as is frequently done. But it is essential and on the whole most desirable for the brick pores to be filled before the materials within the furnace can enter them and so alter the structure that the original properties of the brick are no longer existent. This function of cements and powders will do the most good. I do not think that the use of cements and powders ¼ in. thick between bricks in any manner lengthens the refractory service, but I do believe that a thin wash of these high-grade cements as pore fillers, with a surface-to-surface contact of the brick, evenly bearing and coincident, will materially increase the life and durability of that setting. It is not alone in the bonding property of these cements that their virtue lies; the ability to close up the pores is equally important. Furthermore, to assist in closing the pores of the exposed working surface, I strongly recommend the use of refractory washes to the whole surface of the wall. This not only covers the joint openings but effectively prevents the penetration of vapors and gases beyond the working surface of the lining.

Formulas for Refractory Washes

These refractory surfacing coats have not had the attention with refractory manufacturers that they deserve. In a number of furnace settings I have had excellent results both on basic and acid walls with washes and plaster mixtures, of which the following are typical:

For basic walls of magnesia brick. Mix 90 parts of dead-burned magnesia (60-80 mesh) and 10 parts of plastic magnesia (80-100 mesh) to a plaster consistency with 15.5 deg. Bé. solution of magnesium chloride or with a 25 deg. Bé. solution of magnesium sulphate. Apply with a plasterer's hawk and trowel to about ⅛ in. thickness and dry in air for about 10 hours. If a thicker coat is desired, apply again. Usually a coat greater than ⅛ in. thickness is not as durable as one of this thickness.

For acid walls of silica brick. Mix 98 parts of pure silica powder (80-100 mesh) and 2 parts of portland cement with warm water to a plaster consistency, and apply with a plasterer's hawk and trowel to about ⅛ in. thickness. Dry in air for about 10 hours, and burn in with the furnace. Or mix 97 parts pure silica powder (80-100 mesh) and 3 parts best grade fireclay with warm water to a plaster consistency, and apply with a plasterer's hawk and trowel to about ⅛ in. thickness. Allow to air set for 6 to 8 hours, and burn in with the furnace.

There are on the American market several cements appropriate for this use, but the user should determine from the manufacturer the proper cement to use for the brick he is to surface.

Allowing for Expansion

The linear expansion of brick is sometimes considerable in a furnace wall. Take for an example a silica brick wall in the lining of a furnace, for horizontal expansion.

A circular furnace of 72 in. inside diameter. Wall thickness 9 in. of lining, header brick. Diameter on the neutral circle is computed: (72 in. + 9 in.) × 3.14 equals 254.3 in. Expansion of silica brick at 1,700 deg. C., 2.5 per cent; 254.3 × 0.025 equals 6.35 linear expansion. Deducting this from 254.3 leaves 248 in., which is what the bricks must cover in the cold condition; 248 divided by 4.4 equals 56 brick in the circle. The 6.35 in. must be provided for by the use of expansion fillers which will crush when the expansion pressure is exerted on them. Therefore wooden fillers are used, and in this case 12 fillers of ½ in. thickness, equally spaced around the circle, will accommodate the expansion.

This allows for horizontal expansion only. The vertical expansion will be taken care of, because the lining wall is free to move in a vertical direction, having no restrictions at the top.

Here we come again to the necessity of even bearing, surface-to-surface contacts in brick settings. Where such conditions exist and the structure is built with uniform flat bearing surfaces, expansion takes place

uniformly and evenly throughout the mass. The subsequent contraction is also uniformly distributed and the whole mass moves as a unit and not indifferently, as is the case when bricks are not in contact, under unequal strains and bearing unequal and distorted pressures.

Header and Stretcher Courses.—The setting of brick as headers or stretchers has been referred to under the previous paragraphs. It seems to be the general practice to set bricks as headers in furnace lining walls. This practice gives a more stable construction to the wall; it presents to the furnace heat and products of the furnace the most resistant part of the brick, the end, and it maintains integral a wall of proper working thickness before renewal is necessary. By the keying of the circle bricks, the structure is made self-supporting, when the furnace is tilted for pouring.

Backing Walls

Backing walls may be considered as the permanent walls of the furnace. A backing wall is usually laid permanently against the furnace shell, and acts as a retaining wall for the lining, and a protection to the steel shell.

The use of backing walls in electric steel furnace construction is general practice. When only a lining wall is used, operators run until it approaches too near the shell and then reline the whole shell. By the use of backing walls, a constant protection to the shell is provided. For the lining wall is all that is corroded, and the backing wall is never allowed to melt or flux out. The use of a backing wall also reduces the amount of high-grade refractory required for the lining wall proper.

Backing walls may be set up of No. 1 fireclay brick or of silica brick. The backing wall should be set carefully, solidly and with the idea of permanency. It is advisable to set up backing walls with thin wet wash between contacting surfaces. Avoid the use of bats and fine filling material to fill up holes and irregularities in the brick setting. Make the wall true to the form of the furnace shell, and give it a slight flare on the inside, to the top. A slope of about ¼ in. per foot of height is sufficient. It is also good practice to set a ⅛-in. asbestos sheet against the shell and build the backing wall directly against this. This allows for expansion and movement of the setting.

Constructing Hearths

The brick base of furnace hearths should be set up dry. This is an advantage for many reasons: (1) There is no necessity of drying out after setting; (2) there is no brick deterioration from steam formed during the drying periods; (3) bottom-making material may be put in and burned as soon as the brickwork is finished; (4) it requires careful brick setting, and no filling of cracks and openings with wet filler and bats is permitted; (5) it makes a foundation for the sintered bottom with no moisture content whatever.

The hearth brick should be set up to conform to the shallow saucer-shaped bottom of the furnace. It is not essential that the bottom of the furnace shall be saucer shaped, but the inner contour of the bricks may be given this shape. Although now in most types of furnaces the bottom shell plate is curved, so that by setting the hearth brick on end, they conform to the bottom and produce the saucer-hearth shape desired.

The banks of the furnace are distinctly a part of the furnace hearth. It is on the banks that great corrosive action is evidenced. Properly considered, the banks of the furnace are designed to eliminate deep sharp corners in the metal bath. Where the side vertical walls and the bottom meet there is an angle of 90 deg. and over. It would not be practical to handle a heat of molten metal with a cross-section like a rectangle. So in order to eliminate the sharp corners and the attendant undercutting action that would take place on the side walls, this angle is filled in and a fillet is formed, better known as the "banks" of the furnace. The banks are usually formed of refractory material in the form of ⅜-in. and ½-in. grains. They protect the side walls from cutting action of slags and also give the metal bath a thin section on its periphery with gradually increasing depth toward the center of the furnace, where the major part of the heat is generated and where the mass of the metal can take up this heat.

Refractory cements, properly used, play a very important part in increasing the durability of furnace settings. Applied in the form of a wash over the entire exposed surface of the lining, they function admirably to seal over the joints and to fill the pores of the brick, thus effectively preventing the penetration of vapors and gases beyond the working surface of the lining.

As the angle of rest for the material used and the size of the material determine the slope of the banks, the maintenance of the banks is dependent on these factors. Naturally every melter wants to "lay" the material just where it is needed, and the flatter the slope of the banks the easier his task becomes. But there are limitations in the width of banks that may be maintained.

The furnace designer so designs the furnace that it will carry a certain weight of molten material, having a certain average depth of bath. He also allows for the slope of the banks, which will give a certain area of bath. These original capacities often have to be exceeded, and it is up to the melter to produce a large heat. However, it is the tendency today for furnace manufacturers to underrate their furnaces in holding capacity. For example, a furnace rated at 3 tons will hold under extreme requirements a 4.5-ton heat. This is the exception rather than the regular practice. And this same 3-ton furnace will normally produce 3.9-ton heats. This condition, of course, implies that the electrical capacity of the furnace will carry the overload and produce heats in a reasonable length of time.

Increase in capacity may be obtained by widening the hearth or by deepening the metal bath. Both means are at the service of the melter. By widening the hearth the melter must increase the area of the bath, thereby decreasing the slope of the banks. Also he may deepen the bath by cutting down the hearth. Another procedure is to reduce the original lining thickness, so as to accommodate the larger bath area. But in any properly designed furnace the area of the electrodes bears a definite relation to the area of the metal bath, so that by increasing the metal bath area the efficiency of the furnace is affected negatively. Such procedures are usually required only under extraordinary conditions and only when periodic heats larger than the normal capacity of the furnace are required.

The hearth of the furnace is the hardest worked part of the furnace refractories. Yet its long life is secured by the facilities for patching and constantly repairing it after each heat. The fact that the hearth is horizontal and the banks are at a comparatively flat angle makes it easy to get materials to lie where they are needed for repairing. In no other part of the furnace lining is this so. As a consequence the hearth of the furnace has the longest life, and a properly burned-in hearth will last from 18 to 24 months.

Electrode control will materially affect the wear and cutting of the hearth. Frequently electrodes have been known to bore their way right down through the hearth. This is, of course, poor furnacing on the part of the operator, and indicates a lack of control regulation on the regulating equipment.

Roof Problems

Furnace roofs present many problems on electric furnaces. The problem all operators are trying to solve is to get material and construction that will give them the maximum tonnage from a roof. As soon as a roof completes a service that is in excess of any previous service, the facts are at once made known to the industry and duplicates of that particular roof are in demand.

Furnaces are now built and operating with roofs of various materials and of various types of construction, such as: silica brick roofs, most generally used; magnesia roofs, gradually being replaced by silica; carborundum brick roofs of Carbofrax brick; monolithic roofs, in which the material is tamped in a form, dried and burned; dome-shaped roofs; single arch roofs; flat center roofs, in which the center brick are special shapes around the electrode openings; fixed roofs, built right on the furnace and removable only when the roof is taken down; removable roofs, in which roof is laid up and held to form by a roof ring or a structural form as in the case of square and rectangular roofs; lifting roofs, in which the roof lifts back (like the lid on a box) for charging the furnace; water-cooled roofs, in which the supporting ring is a water-cooled casting.

The mechanical design of the roof is a feature that is often dependent on the particular furnace and its characteristics of operation. The material composing the roof refractory is a factor that bears quite a similar relationship to the design of furnace and its operating characteristics.

Silica brick is the most universally used refractory in electric furnace roofs today, whether for acid or basic melting and refining. This general practice has been adopted for many reasons, of which the following are typical: (1) The high-softening temperature of the material; (2) the moderate first cost of this refractory, as compared to other high-softening-temperature refractories; (3) its applicability to acid and basic furnaces alike; (4) the ability for manufacturers to produce special and large shapes of this material; (5) the good results obtained without the necessity of water cooling; (6) the comparative freedom from cracking and excessive spalling with wide temperature changes.

Setting Up Roofs

By a series of observations, tests and experiments under actual operating conditions it has been proved that the roof that is set up with the bricks fitted and with close contact surfaces all bearing gives a longer operating life and greater tonnage than one not so carefully and mechanically constructed. The life of the roof may be computed in "hours on load," "tons produced," "tons melted" or "ton-hours."

Roof deterioration is traceable to two prime causes: (1) slagging and melting, due to fluxing of the refractory by dust and vapors, which come from the ingredients of the charge. The subsequent softening and melting consumes the material. (2) Cracking and spalling, due to unequal bearing pressure on the individual bricks in the setting and to susceptibility to temperature changes. The spalls soon drop out and the arch is consequently weaker. The first cause may be eliminated to a considerable extent by furnace operations referred to later in this article. The second cause may be eliminated by suitable and proper construction.

All furnace roofs are constructed on the principle of the arch. This principle when properly applied makes the structure capable of supporting its own dead weight of material. The vertical weight of the material is transmitted laterally through each member, in the setting, to the skew bricks from which the arch springs and which are in turn held in position by the containing ring or wall. Strength in such a structure as this depends entirely upon the load being uniformly and equally distributed to each member. If any member in the structure is not carrying its quota of the load, that member is not a part of the structure and will either fall out or crack from the unequal pressure exerted upon it.

When a roof is placed in service, it is at once subjected to heating, which brings about expansion. Immediately every brick assumes, or tries to assume, the position in which it will fit snugly with adjacent members. In most of the roofs constructed only about 60 per cent of the total brick area available for contact bearing functions properly. It is apparent that this condition cannot make for a strong structure, for as soon as expansion takes place a change in volume results and bricks are cracked by the unequal stresses which develops. On cooling, the volume reduces and the spalls fall out.

The cause of this trouble is easily located and may be rectified. It has been the experience of furnace builders, operators and refractory makers that roof brick should be made specially to suit the curvature of the arch for the required thickness of roof. Each brick therefore is keyed brick, which accurately fits into the structure with its adjacent member. It was recognized that ordinary brick would not give the fit required for the strength of the structure and for the proper distribution of the load through each member. The improvement was in the right direction. But imperfection still exists, and what is wanted is true, even, flat surfaces on the contact-bearing surfaces of the brick. To attain this may require some changes in the brick manufacturing process, but this improvement should be in line with the desire of every manufacturer to perfect his product. Why make a brick with a 4½x9-in. surface if it is possible to utilize only 50 per cent of this surface for bearing, because of hollows and bumps? Much improvement can be attained in this direction in brick manufacture, and the benefit to the user of the brick is of the greatest magnitude.

Roof brick should be set up dry without water emulsion bond or filling. But sealing of the joints is important. Tar-dipped brick very effectively seal off the joints and fill the surface pores. Dipping in tar has three beneficial results: (1) Closing the joints by the

residue of coke left after heating up the roof; (2) closing of surface pores of the brick; (3) the coke residue forms an effective resistance to the penetration of gases, vapors and sublimates into the joints. Wood expansion fillers must be used on all silica brick roofs. Allow $\frac{1}{4}$ in. expansion for each 10 in. on the arch.

Dry sand filling and cement fillings, when made thick between joints, are of little advantage in roof setting. Covering a roof with sand or cement on the outside is injurious to the durability of the roof. The top of the roof should be kept clean and free from such materials. Brick masons have a habit of smearing the outside surface of the roof with washes and cements after the brick are set up. Refrain from such practice, as the accumulation of material on the top of the brick causes hot spots and premature burning out of those spots.

The thickness of a roof is not determined by theory or by calculation. It is determined from practice and experience. It has been found that the thickness of a furnace roof is determined by the furnace itself, and all that is required is to observe the result. A roof of unnecessary thickness is no advantage. The excess will melt away. The radiation from the roof and the conduction of heat through the roof must at all times be such that the inside surface temperature does not exceed the melting temperature of the refractory. The thickness of the roof is the determining factor and the roof will melt until equilibrium is established. A roof of too great thickness constructed of any material having a melting temperature within the range of the operating furnace temperature will thin itself by melting away. In general practice today furnace roofs are constructed about as follows:

250 to 1,000 kva.	$\frac{1}{2}$ to 4 tons capacity	9-in. silica roof
1,500 to 3,000 kva.	5 to 10 tons capacity	12-in. silica roof

For truing up irregular surfaces the same practice may be followed as outlined for "Lining Walls." Considering the difference in structure between a wall and a roof, it may be readily appreciated how important this feature becomes in roof construction.

General Conclusions

Much of the improvement in refractory service must come from the refractory manufacturer. Inherently much of the value of the refractory exists in what the manufacturer puts into it.

The intelligent use of the materials by the furnace operator is prerequisite. Refractories must not be exposed to the weather. They should be stored in a building where they will be kept dry and at an even temperature.

The wide range of results from the use of furnace refractories shows that greater knowledge and skill is required in their use. Much of the variation is caused by mechanical imperfection.

A brick is just as much a factor of importance in a refractory setting as a steel section is in a structural steel fabrication. Its physical dimensional features are important.

A more intelligent use should be made of cements and pore-filling materials. These materials should not only be sold and put to use as so-called binders but they should be used to fill pores and close off joint cracks. More extended use of such refractory cements for wall plasters should be advocated; and their use in thin washes only (not $\frac{1}{4}$ in. thick) when used in joints.

The ways of our grandfathers can be improved upon.

American Tannin Supply Threatened

The chestnut blight, a destructive fungus disease, is steadily destroying the chestnut growth of this country, and there is no prospect of stopping or of materially delaying its progress. William A. Taylor, Bureau of Plant Industry, U. S. Department of Agriculture, states that our leather-tanning industry gets approximately one-half of its supply of native tanning material from the large chemical plants in the southern Appalachians, where the tannin is extracted from the chestnut wood. Our tanning industry is dependent to a great extent on foreign tannins and with the passing of the chestnut it will be even more dependent. It would seem fundamentally unsound for one of our large industries to depend upon tannins from other countries.

With a view to developing new domestic sources of tannin, the Bureau of Plant Industry is devoting attention to locating and introducing tannin-producing plants. Oriental chestnut areas are being explored for blight-resistant species of chestnut and closely related trees to find seeds of such as appear promising for introduction and testing in this country. The most promising appears to be the Chinese sweet chestnut, *Castanea mollissima*, which already grows in a number of localities in the eastern United States and on the Pacific Coast. Recently some vigorous-growing species of *Castanea* and *Castanopsis* have been located in the upper Yangste Valley in China, and a few of these trees have been grown from nuts shipped to this country. However, the introduction on an extensive commercial scale of trees new to America that are capable of replacing our native chestnut is a long-time and expensive undertaking, even if it should be found that they meet the climatic, soil, disease-resistance and other requirements. It is premature, therefore, to suggest that a satisfactory replacement of our chestnut as a source of tannin is in prospect, even in the remote future, although the effort is highly important and should be continued.

More Varied Utilization of Soya Beans Sought

The soya bean, while grown in the United States in a small way for many years, is now rapidly attaining staple crop importance, according to William A. Taylor of the United States Department of Agriculture. The large increase in acreage of the soya bean for seed production during the last 3 years has stimulated many manufacturers to take advantage of the industrial uses of the crop and its products, bean-oil and oil-cake. Factories in the United States are now producing oil, oil-meal, flour, soy sauce, special foods for infants and invalids from the soya bean. Investigations are being made of the possibilities of milk powders and vegetable casein. In view of the rapidly increasing acreage and popularity of the bean it is believed that it will become one of the leading farm crops throughout a wide geographic area.

The soya bean differs quite markedly from most other plants in its greater content of nitrogen, oil and mineral substances, and in the character of these substances. Large quantities of soya bean oil are used in the manufacture of lard and butter substitutes, rubber substitutes, soaps, celluloid, and lighting and lubricating oils. Quite recently, by a German process, lecithin is being extracted from soya bean oil, which so far is understood to be the only known vegetable source of this substance.

Rule of Thumb Displaced by
Modern Mixing Methods

Controlled Raw Materials and Efficient Mixing at a Central Plant Produce a Better, Cheaper Sand-Lime Mortar for Building

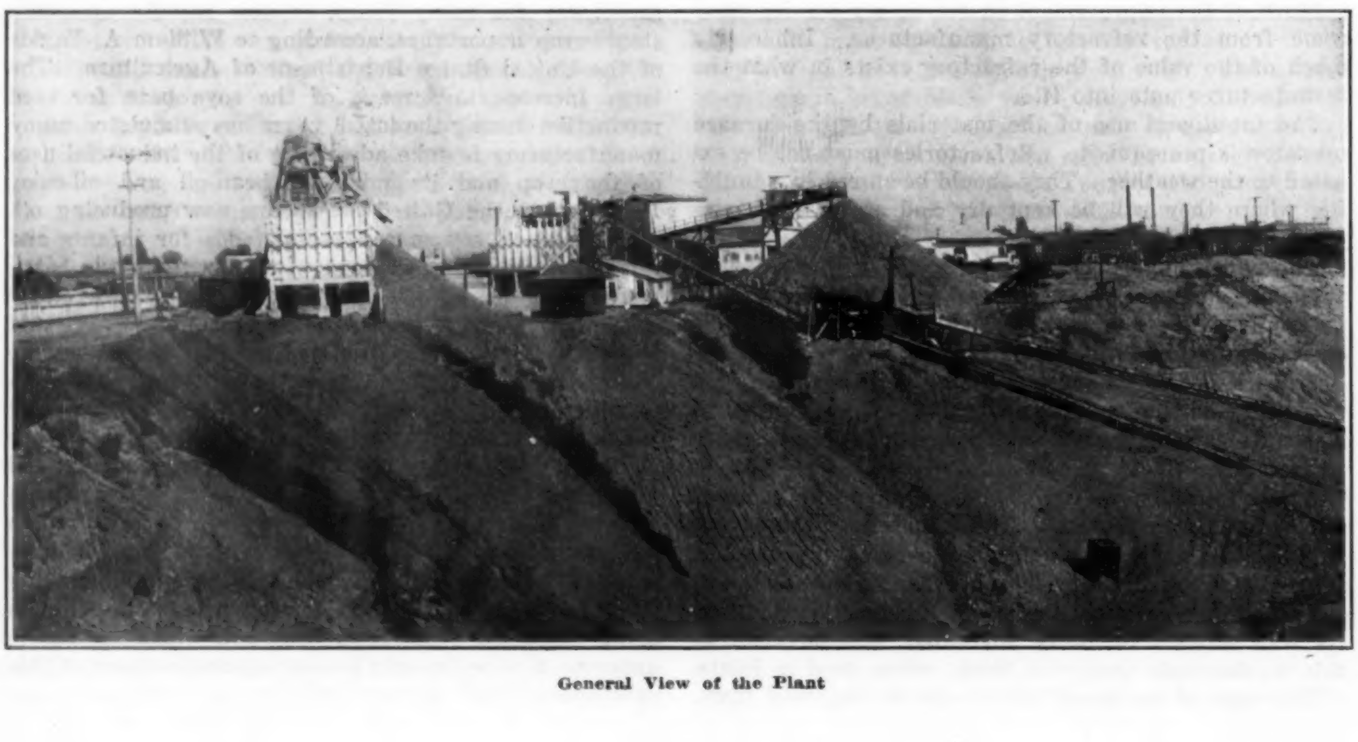
BY A. W. ALLEN
Assistant Editor, *Chem. & Met.*

THE value of sand-lime mortar depends primarily on the quality of the materials used in manufacture; secondly, on the method of preparation and mixing. It is also worthy of note that ease of application of the mortar and lowest cost for material and labor are achieved when the product is prepared strictly according to specifications. Furthermore, it is now found that aëration of the lime putty is an important aid. The proportionate amount of sand and lime is no longer determined in up-to-date plants by guesswork, or by the mysterious intuitive apprehension of the experienced, "practical" mortar mixer, who formerly added a little of this, then a little of that, according as to how the mass fell from the hoe while the tedious process of hand mixing was in operation.

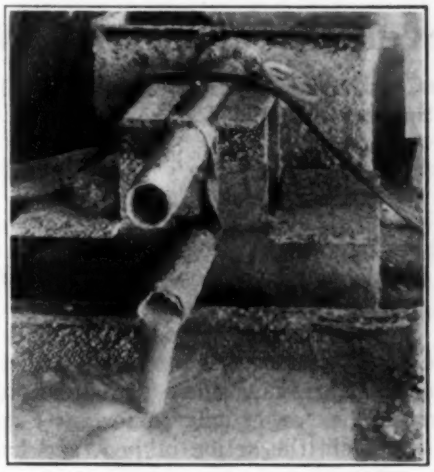
The days of hand-mixed mortar for building, at least in large cities, seem to be numbered. Here is a story of the application of technical equipment and scientific control to the production of a material the preparation of which in customary practice represents a good example of rule-of-thumb methods.

This testing and experimentation is now no longer necessary. Limestone of definite chemical composition is burned in kilns under conditions that can be duplicated with exactness. Sand from a natural deposit can be screened and graded so that it conforms strictly to specifications. The slaking of lime and the preparation of lime putty involves no more than the duplication of conditions that have been proved to give the desired results. When these have been determined, the personal element no longer enters into the question.

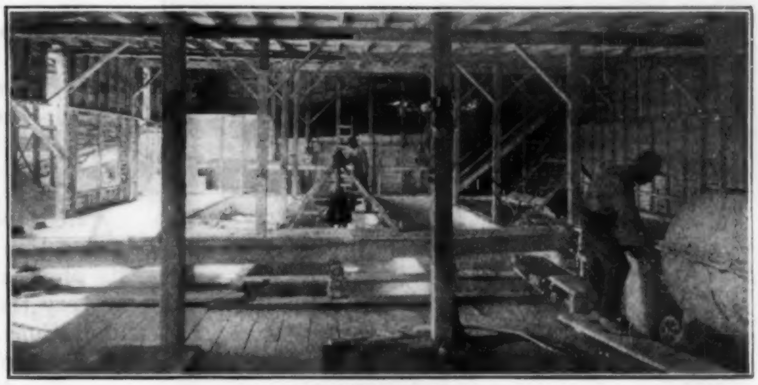
At the Los Angeles plant of the Blue Diamond Materials Co. the mechanization of the process of mixing sand-lime mortar has been due to the initiative of William C. Hay, the president of the company, who holds patents for process and apparatus. The lime, from the company's kilns at Summit Switch, is delivered to the plant at Los Angeles, where a predetermined amount goes to a spiral type of mixer, together with the requisite amount of water. After slaking is complete, the discharge pipe is opened and the product passes through a coarse screen, to the conditioning vats, where it is "cured." These vats are each equipped with a motor-driven agitator paddle, which can be moved lengthwise, on rails, as desired; the agitation treatment, which is intermittent, is found to effect a desirable aëration of the product, producing



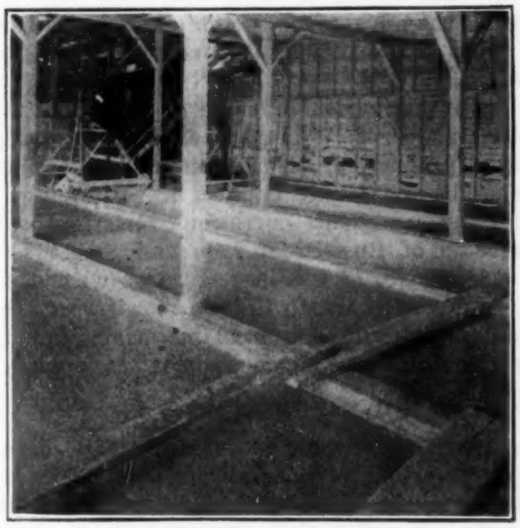
General View of the Plant



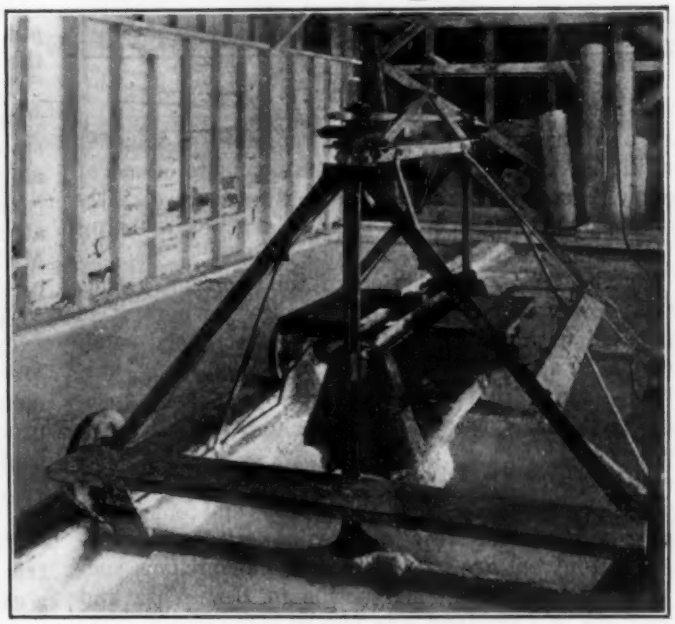
Delivering Slaked Lime From Mixer



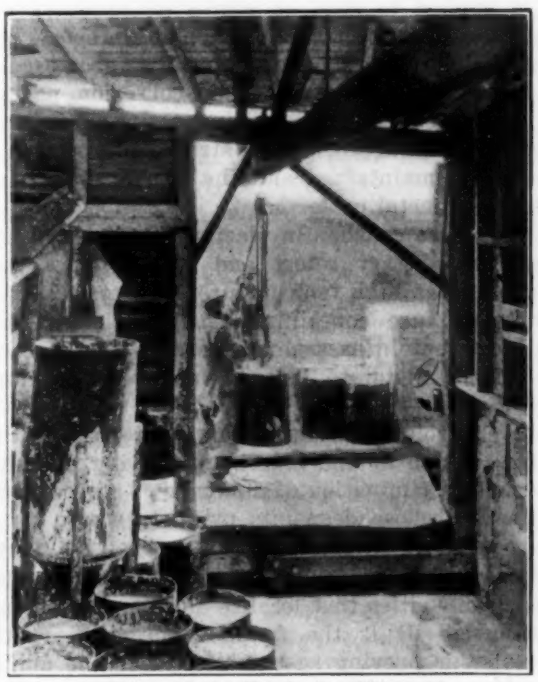
Lime-Mixing Room



Conditioning Vats

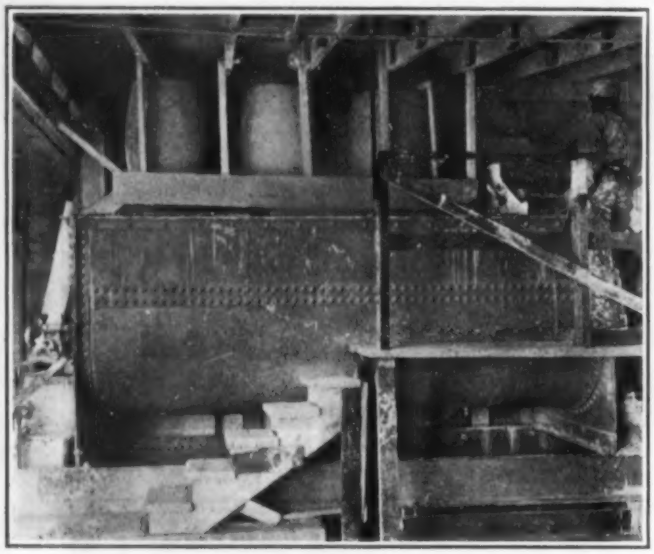


Traveling Mixer-Aërator



Lime Putty Ready for Shipment

Mortar Mixer



Lime-Slaking Machine

mortar or putty of much greater "spread" and easier workability. After this operation is complete, some of the putty passes to other conditioning vats directly underneath, where it is aged in the dark before being filled into cans for delivery to motor trucks.

By far the larger proportion of the lime putty that is made, however, goes to a knife mixer, where it is incorporated with the proper amount of screened sand. The result is a dependable product of unvarying uniformity. This is delivered direct to the motor truck, by which it is speeded to the scene of building operations.

The success of the Hay process throughout North America, largely because of simplicity and efficiency, has been immediate. New installations at Boston, Atlanta and Montreal are operating with conspicuous success. Plants are under construction in New York and Chicago; one in Cleveland was put in commission early in September and has already made an enviable record. Philadelphia is expected to have a new unit in operation before the end of the year.

For permission to view the Los Angeles plant and for information that permitted the compilation of these notes I am indebted to K. M. Grier, of the executive department of the Blue Diamond Materials Co.

Delivering Mixed Mortar at Building Site

Use of Aluminum to
Prevent Steel Corrosion

This Process, Called Calorizing, Consists in Alloying the Surface of Steel With Aluminum

BY ARTHUR V. FARR
The Calorizing Co., Pittsburgh, Pa.

ALUMINUM as a material for resisting corrosive action has long been recognized. By reason of its physical characteristics when in the form of tubes or very thin sectioned sheets, its use has quite definite limitations. Since calorizing embodies the principle of an aluminum alloy surface, its use as a resistant to corrosion has been a growing one. The aluminum alloy coat of calorizing has an equally important characteristic in that it resists the action of heat and has been put to use in many places where this latter quality is the prime one.

When calorized steel tubes are used, they have of course all the advantages of the structural strength of steel tubes together with the corrosion resistance of aluminum.

In his investigation of some of the early attempts at calorizing, Prof. W. P. Wood of the University of Michigan prophesied, "If the aluminum coating could be smoothly and evenly applied, it [calorizing] would furnish an excellent corrosion resisting surface." ("Corrosion of Rust-Proof Iron and Steel," *Chem. & Met.*, vol. 28, No. 17.) Since the days when the specimens referred to by Professor Wood were used the process of calorizing has been materially improved so that a smooth and even calorized coat is applied.

WHAT THE PROCESS IS

The calorizing process, patented by the General Electric Co., is applied to materials already made. It is not a cast alloy but a surface treatment by which aluminum is actually driven into the metal (not merely deposited) and forms a new surface of aluminum alloy. The process is applied to steel or semi-steel products such as pipe, tubing, bars or other sections, thin sheets or small pieces. Calorizing renders material so processed resistant to heat, abrasion and certain corrosion, particularly air, water, electrolytic, alkaline and certain acid and other chemical actions. The structural strength of the material is maintained and the coating is an integral part of the metal protected.

The process consists in placing the material, such as tubes, in a rotary retort and heating in a reducing atmosphere of high temperature, the retort being filled with a mixture containing finely divided aluminum. The treatment infuses aluminum into the exposed portion of the metal to form a homogeneous aluminum alloy.

The electrolytic theory of corrosion explains the protective action of the aluminum coating of calorizing material. Examination of a sample of corroded modern steel will disclose deep pits or spots where the metal has been eaten through by rust. Analyses show that steel products of today, due to rapid production methods, contain impurities that localize and hasten corrosion by electrolysis. It is the familiar action of rusting in spots that is proving so troublesome in the application of modern iron and steel today. Aluminum is electropositive to iron and because of the results secured by the process of impregnating aluminum into every void

in the surface of the steel and alloying with the steel itself, densifying the surface and building it up to protect the base metal, corrosion of the base metal is definitely retarded by calorizing.

The first industry to adopt calorizing because of its ability to resist corrosion was the oil-refining industry.

Calorized material with its aluminum-coated surfaces is unaffected by sulphuretted hydrogen, sulphur dioxide, sulphur vapor, carbon monoxide and the furnace gases and vapors usually found in refining practice. The action of Mexican, California and other oils containing corrosive ingredients such as sulphur, salt, etc., is not nearly so rapid on calorized surfaces as on plain steel.

Corrosion of Metals by Still Vapor

A test of various metals suspended side by side in the upper drum of a pressure still for a continuous period from Oct. 24 to March 1, Mid-Continent crude oil being cracked:

Material		Loss in Lb. Per Sq.Ft. of Exposed Surface
Calorized steel		0.013
Calorized steel		.004
Steel plate		.502
Steel plate		.390
Tank steel		.412
Alloy No. 9 (patent composition)		.170
Alloy No. 136		.159
Alloy No. 4		.106
Copper-nickel alloy	(36 Cu, 60 Ni, 4 Fe)	1.204
Bronze alloy	(60 Cu, 38.2 Zn, 1.2 Sn)	.056
Alloy No. 3	(70 Cu, 30 Zn)	.126
Alloy No. 2	(70 Cu, 29 Zn, 1 Sn)	.090

This test indicates that the loss due to corrosion with calorized steel is less than one-fourth the loss of the next best material. This series of tests has been duplicated by other refineries with almost identical results.

Corrosion of Vapor Lines

The installation of vapor lines, overhead circulation lines and transfer lines, where pipe is frequently fabricated to special shapes and in large size, is very expensive. Not only is the expense of material involved but the cost of labor makes such equipment a heavy item of plant cost. Where such equipment is used in connection with a crude oil stock running high in corrosive agents, the use of calorizing is especially recommended. Some plants are obliged to replace their overhead pipe at least once a year, and the shutdown for replacement cuts down production very appreciably.

Calorized pipe can be bent to shape to meet these requirements and the increased life and freedom from likelihood of early shutdowns is a significant factor. Some of the largest oil companies have standardized on calorizing for vapor lines and other places, subject to the corrosive action of oil vapors.

Corrosion Tests of Calorized Steel Sheets

The following information is supplied by S. Gulbrandsen, of the Welsbach Co.:

"Some dip-calorized steel sheets were exposed to the atmosphere of the laboratory for a period of 2 years, acid fumes being frequently present, particularly hydrochloric acid and nitric acid. They now show only a faint surface film of oxide, whereas the untreated steel sheets exposed under the same conditions are very deeply corroded. I do not mean to infer from this that calorized steel is proof against acid fumes of all kinds and concentrations, but it has been found superior to ordinary steel.

"Test pieces were exposed for a period of 2 years in a damp cellar where the humidity must be pretty close to saturation at least 7 months in the year (when the furnace is not going). The steel sheets are badly rusted, while the dip-calorized samples show no trace of rust.

"Test pieces were exposed on the roof to outdoor conditions for a period of 10 months. The plain steel sheets showed deep corrosion, whereas the dip-calorized sheets showed only a very slight film of surface oxidation—hardly enough to notice."

In comparing calorizing with sherardizing as a resistant to corrosion, it is a fact that aluminum is to all intents and purposes less active chemically than zinc, and as aluminum does not form sulphide either in aqueous solutions or by direct combination when heated, it would seem that calorized material should be superior to sherardized material.

Asphalt Specifications Recommended

The following sections of Simplified Practice Recommendation No. 4, just issued by the Bureau of Standards, indicate the important progress which has been made in this field.

Producers of asphalt for road and paving work, believing that the multiplicity and non-uniformity of specification requirements for their material had reached a point which demanded nation-wide co-operative action of all interested in this commodity, requested the Division of Simplified Practice of the Department of Commerce to call a preliminary conference on April 24, 1923.

A large representative group of manufacturers was in attendance. The final conference to consider the data as disclosed by the survey was set for May 28, 1923. The personnel in attendance at this final conference indicated the widespread interest in such constructive movements.

Some very interesting data resulted from the survey as conducted by the division. Out of 22 forms of inquiry 14 manufacturers reported 88 varieties of asphalt being used for paving purposes, with 14 varieties for brick and stone filler.

For construction ranging in type from asphalt macadam penetration to sheet asphalt pavement the survey showed 9 grades of material are ample, but under present conditions of non-uniformity on specification requirements more than 80 grades are called for.

In accordance with the unanimous action of the joint conference the Bureau of Standards recommends that recognized varieties of paving asphalt be reduced as follows:

For construction of sheet asphalt, asphaltic concrete, and asphalt macadam pavements, and also for surface treatment the penetration limits are to be 25 to 30, 30 to 40, 40 to 50, 50 to 60, 60 to 70, 85 to 100, 100 to 120, 120 to 150 and from 150 to 200.

For joint filler for various types of construction, the penetration limits are to be from 30 to 50, 50 to 60, 60 to 70 and from 85 to 100.

In this last class the first is used primarily for brick pavements, and does not require the admixture of sand, whereas the latter three, which are identical with three of the grades adopted for asphalt pavement construction, are those which would ordinarily be used in admixture with sand to produce an asphalt grout.

This recommendation is to become effective on all deliveries of material after Jan.. 1, 1924.

Fundamental Principles of

Multiple Effect Evaporation

An Analysis of the Relation of Heat Conductivity to Temperature Differences in Evaporating Waste Sulphite Liquor

BY HUGH K. MOORE

Technical Director, Brown Co., Berlin, N. H.

EVAPORATION

In concluding his discussion of the basic factors underlying efficient evaporator design and operation, Mr. Moore gives us in his present article an intimate study of heat conductivity relations. His method of presenting this subject is distinctly unique and of broad interest to the chemical engineer in any industry that faces an evaporation problem.

A UNIT PROCESS OF CHEMICAL ENGINEERING

REFERRING to Tables I and II, you will observe that if you compare the heat conducted in an effect of Table I to that conducted in the corresponding effect of Table II there is a variance in amounts. Table I has a temperature spread 100 per cent greater than in Table II and thus requires more initial steam for the same amount of evaporation, and the effect of this steam is to increase considerably the total amount of heat conducted.

Now if you compare Tables III and IV, you will find that the same 100 per cent difference in temperature spread in backward evaporation makes, on the average, very little difference in the heat conducted, though the effect of the greater amount of steam is still visible. In either case the variations in the total heat conducted in all the effects does not vary much over 2 per cent, an amount that is negligible. If, now, the total heat conducted through the tubes in each effect is divided by the product of the heat conductivity at the required percentage of solids at the corresponding temperature level and the temperature difference, we get the square feet of heating surface.

DETERMINING HEAT CONDUCTIVITY

Figures 5, 6 and 7 should prove helpful in ascertaining heat conductivity. These figures show the heat conductivity using 5, 10 and 20 degrees difference of exchange for sulphite liquor at varying temperature levels and varying percentages of solids. For example, let us take Table III and we find 50 per cent liquor in No. 1 effect boils at a 200 deg. F. temperature level, with a temperature difference of 20 deg. F. By referring to Fig. 7 we find 50 per cent liquor at 200 deg. F. temperature level has a heat conductivity of 382. Then 1,704,000 ÷ 20 × 382 = 206, the square feet of heating surface in No. 1 effect. In like manner the heating surfaces in the other effects are determined. If we add all these heating surfaces together, we find we have a total heating surface of 1,000 sq.ft., or an average of about 167 sq.ft. each. It often happens that a mill is contemplating the evaporation of certain liquids and has only space to put up a certain-sized evaporator and it is desired to know if steam available at certain pressures can be used for this purpose. In this case the heating surface is known but the temperature levels and the differences of exchange are not known.

Adapted from a paper read before the American Institute of Chemical Engineers, at Washington, D. C., Dec. 5, 1923. For Parts I and II of this article the reader is referred to *Chem. & Met.*, Dec. 17, 1923, pp. 1102-1105, and Dec. 24, 1923, pp. 1144-7.

Table III—Backward Evaporation With 120 Deg. Temperature Spread

Liquor enters 160 deg. F., contains 8.54 per cent solids, the specific heat of which is 0.5. Temperature spread 220 deg. F. to 100 deg. F. No hydrostatic head. Basis 1,000 lb. solids. (No allowance made for radiation or rise in boiling point.)

	Boiler	1st Effect	2d Effect	3d Effect	4th Effect	5th Effect	6th Effect
Difference of exchange	.....	20	20	20	20	20	20
Lb. steam from	1,766	1,678	1,594	1,520	1,426	1,380	2,100
Per cent solids leaving	.....	50.00	27.17	18.94	14.72	12.16	10.42
Heat conducted (Q) B.t.u.	.....	1,704,000	1,676,320	1,646,880	1,623,760	1,575,160	1,574,680
Temperature level, deg. F.	220	200	180	160	140	120	100
Conductivity K	.....	382	676	682	603	464	324
Heat conducted 20 K, heating surface	.....	206	125	121	135	170	243
Temp. levels with 167 sq.ft. each	220	192	177	162	146	128	100
Heat conducted ÷ heating surface	.....	10,190	10,030	9,865	9,725	9,432	9,271

Total heating surface 1,000 sq.ft. Average heating surface 167 sq.ft.

Table IV—Backward Evaporation With 60 Deg. Temperature Spread

Liquor enters 160 deg. F., contains 8.54 per cent solids, the specific heat of which is 0.5. Temperature spread 160 deg. F. to 100 deg. F. No hydrostatic head. Basis 1,000 lb. solids. (No allowance made for radiation or rise in boiling point.)

	Boiler	1st Effect	2d Effect	3rd Effect	4th Effect	5th Effect	6th Effect
Difference of exchange	.....	10	10	10	10	10	10
Steam from	1,612	1,577	1,563	1,528	1,491	1,457	2,094
Per cent solids leaving	.....	50.00	27.96	19.45	15.00	12.26	10.40
Heat conducted (Q) B.t.u.	.....	1,614,000	1,604,120	1,613,896	1,603,520	1,591,800	1,578,710
Temperature level, deg. F.	160	150	140	130	120	110	100
Conductivity (K)	.....	211	473	484	430	364	310
Heat conducted 20 K	.....	764	339	333	373	437	509

Total heating surface 2,755 sq.ft.

Table I—Forward Evaporation With 120 Deg. Temperature Spread

Liquor enters 160 deg. F., contains 8.54 per cent solids, the sp.ht. of which is 0.5. Temperature spread 220 deg. to 100 deg. F. (no allowance made for radiation or rise in boiling point). No hydrostatic head, basis 1,000 lb. solids.

	Boiler	1st Effect	2d Effect	3d Effect	4th Effect	5th Effect	6th Effect
Temp. diff., deg. F.	......	20	20	20	20	20	20
Steam from	1,570	1,092	1,310	1,528	1,732	1,928	2,118
Per cent solids leaving	......	9.42	10.76	12.86	16.52	24.30	50.00
Head conducted	......	1,515,000	1,099,400	1,350,240	1,610,440	1,864,000	2,120,640
Temp. level, deg. F.	......	200	180	160	140	120	100
Conductivity K	......	980	880	746	588	438	100
Heat conducted 20 K	......	77	62	90	136	213	1,060
Heat conducted	......	5,549	4,028	4,945	5,898	6,826	7,766
Average heating surface	206	199	194	187	179	168	100

Total heating surface 1638 sq.ft. Average heating surface 273 sq.ft.

Table II—Forward Evaporation With 60 Deg. Temperature Spread

Liquor enters 160 deg. F., contains 8.54 per cent solids the sp.ht. of which is 0.5. Temperature spread 160 deg. F. to 100 deg. F. (no allowance made for radiation). No hydrostatic head, basis 1,000 lb. solids.

	Boiler	1st Effect	2d Effect	3d Effect	4th Effect	5th Effect	6th Effect
Temp. diff., deg. F.	......	10	10	10	10	10	10
Steam from	1,265	1,371	1,473	1,572	1,668	1,765	1,859
Per cent solids leaving	......	9.68	11.28	13.71	17.77	25.90	50.00
Heat conducted	......	1,268,000	1,392,650	1,517,360	1,643,090	1,766,810	1,994,490
Temperature level, deg. F.	......	150	140	130	120	110	100
Conductivity K	......	698	610	525	423	336	70
Heat conducted 10 K	......	182	228	288	389	526	2,849

Total heating surface 4,462 sq.ft.

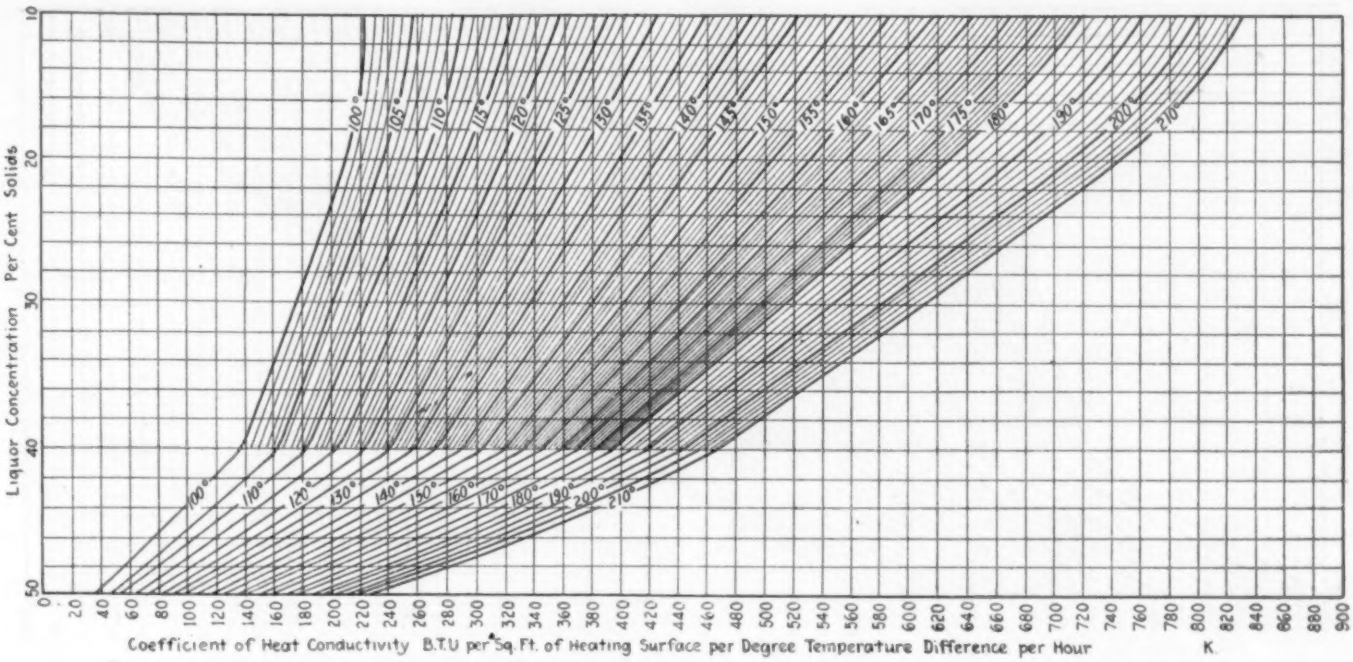


Fig. 5

Evaporation of waste sulphite liquor in horizontal-tube evaporator. Coefficients of heat conductivity from steam to boiling waste sulphite liquors. No hydrostatic head on liquor. Temperature levels from 100 deg. F. to 210 deg. F. Temperature difference between steam and boiling liquor 5 deg. F. Liquor concentrations from 10 per cent to 50 per cent solids.

Suppose in Table III we know the heating surface could be only 167 sq.ft. for each of the six evaporators. We should then make the calculation as usual and having determined the total heat conducted through the tubes in each effect, we could divide the same by the heating surface and get a product of the heat conductivity and the difference of exchange. Now we know the temperature level of No. 6 effect to be 100 deg. If then we look up 9,270 on the 10 per cent solid line on product chart, Fig. 8, we find the difference of exchange is 28 deg. F. If we make no allowance for the rise in boiling point, then the temperature of the boiling liquor in effect No. 5 is 100 + 28, or 128 deg. If the boiling point increased at this concentration, you would add the increase to the 128 deg. If you now look up at 12 per cent solids 9,432 on the 128 deg. temperature level chart you would get 18 deg. difference of exchange. (Note: Although considerably over 100 of these charts have been prepared only one, namely, Fig. 8, is submitted in order to illustrate the type of chart employed.) By this method you can get a fair idea of the temperature spread and temperature levels. In this particular case the total temperature spread happens by coincidence to be the same

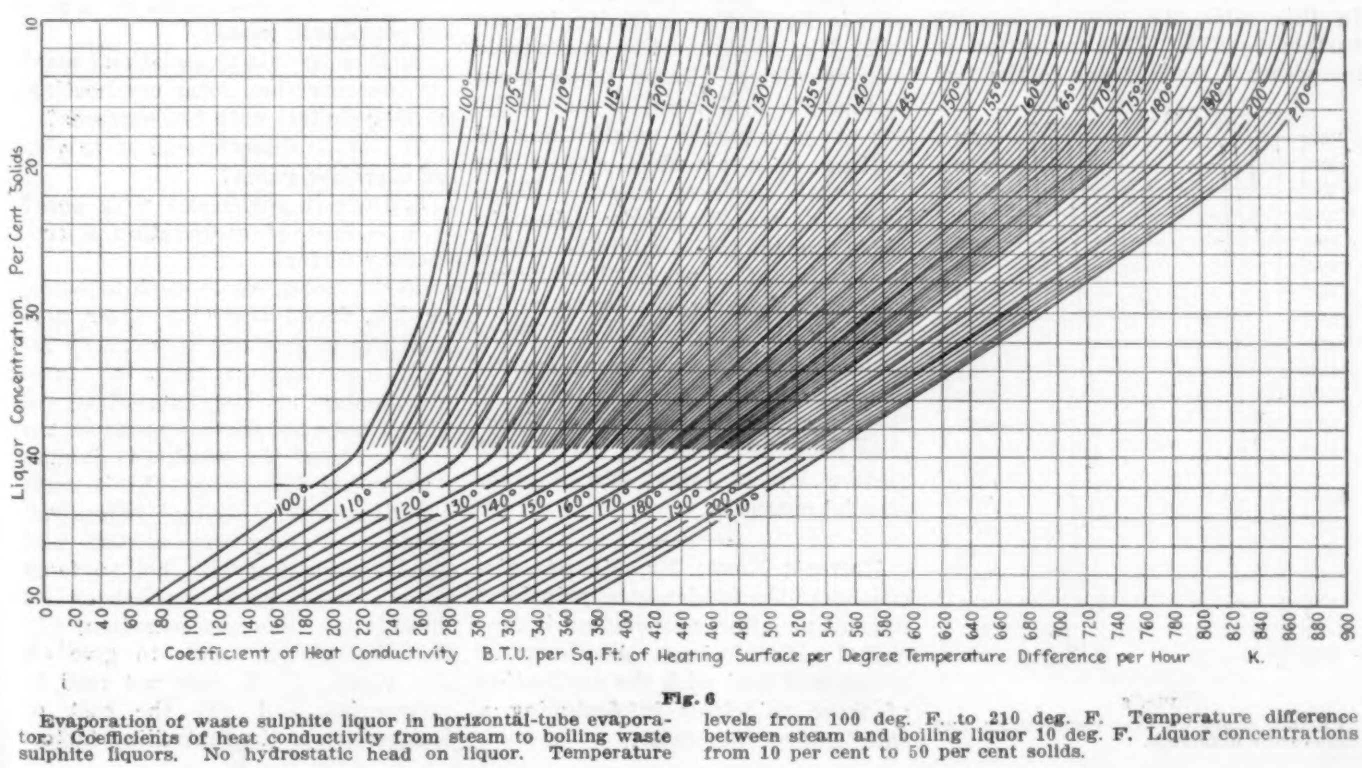


Fig. 6

Evaporation of waste sulphite liquor in horizontal-tube evaporator. Coefficients of heat conductivity from steam to boiling waste sulphite liquors. No hydrostatic head on liquor. Temperature levels from 100 deg. F. to 210 deg. F. Temperature difference between steam and boiling liquor 10 deg. F. Liquor concentrations from 10 per cent to 50 per cent solids.

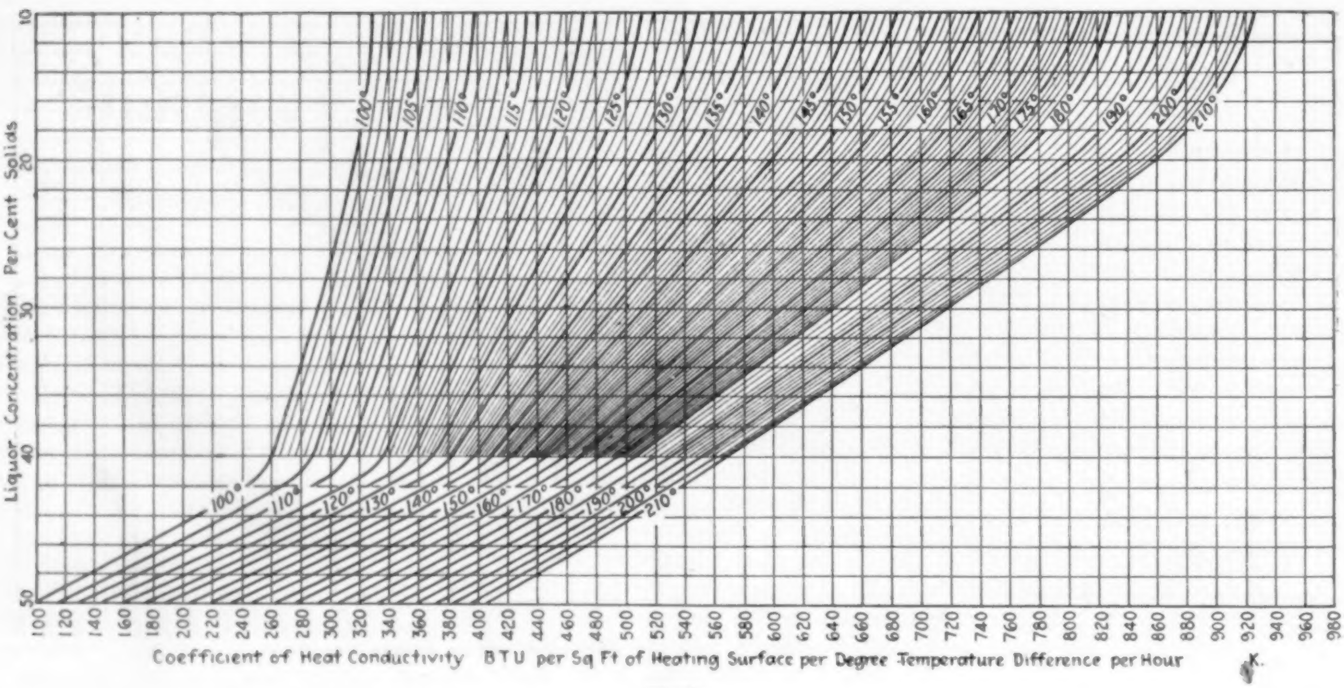


Fig. 7

Evaporation of waste sulphite liquor in horizontal-tube evaporator. Coefficients of heat conductivity from steam to boiling waste sulphite liquors. No hydrostatic head on liquor. Temperature levels from 100 deg. F. to 210 deg. F. Temperature difference between steam and boiling liquor 20 deg. F. Liquor concentrations from 10 per cent to 50 per cent solids.

as that already assumed. This is not usually true, however, for in most cases, even with the heating surfaces obtained by averaging as above, the temperature spread would be less than that assumed. If the heating surface had been greater, the total temperature spread would have been less, and vice versa. If the jump of heating surface in the last effect was great in Table I, then the total temperature spread based on the average heating surface would be less. In this table the average heating surface is 273. This reduction in temperature level is due to the fact

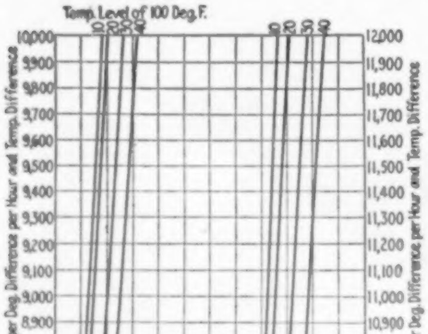


Fig. 8
Product chart of heat conductivity and temperature difference.

that with a small heating surface at a low temperature level the difference of exchange must necessarily be great, and if this is true, then you have raised your preceding temperature levels, and the increase in conductivity due to this cause usually more than offsets the first high temperature difference.

In Table I it is shown that the total temperature spread by this method is only 106 deg. instead of 120 deg., yet the temperature difference in No. 6 effect is 68 deg. instead of 20 deg., as assumed when the table was calculated. These tables must be taken in an illustrative sense only, for no sane person would think of putting in a six-effect system for the small amounts shown. These amounts were purposely taken in order that the tables might be within the limits of a page. For larger capacities these figures can be multiplied by the proper factor. These tables are based on figures experimentally obtained on clean tubes. If these figures are used proper allowance must be made for the several factors which enter into a commercial operation.

Editor's Note: Mr. Moore's discussion of the fundamental principles of multiple effect evaporation is concluded with this issue. A subsequent article will deal with the application of these principles in designing a satisfactory evaporator.

An Evaporator Catechism

Early in his presentation of the foregoing paper, Mr. Moore declared that there are certain fundamental questions to be asked in attempting to solve any evaporator problem.

1. What metals are not attacked?
2. On evaporation does it tend to foam in any of its stages?
3. Does it deposit solids?
4. Does it tend to form scales on heating surfaces?
5. Does it dissociate so as to give off permanent gases?
6. If so, is this dissociation caused by concentration, local overheating, or long contact with hot surfaces?
7. Does it dissociate so as to give off corrosive gases?
8. Does it polymerize with heat?
9. Is cost of evaporation a controlling factor?

In the case of waste sulphite liquor, he has found that (1) after neutralizing it does not appreciably attack iron, (2) it tends to foam abominably at low concentrations, (3) it does not deposit solids in the true sense of the word, (4) it may or may not form scale, (5) it tends to dissociate, giving permanent gases, (6) long-time contact and local overheating with hot surfaces have a much greater effect on its dissociation than concentration, (7) this dissociation tends to give off SO_2 gases, (8) it does not tend to polymerize, and (9) the cost of evaporation is the controlling factor.

Equipment News

From Maker and User

Self-Cleaning Continuous Filter

Design for Which Is Claimed Continuous Operation Under the Full Range of Industrial Conditions

After many years of experiment and research, the James H. Fogarty Co., 95 Liberty St., New York City, has placed on the market an original design of continuous filter which, it is claimed, fills many of the needs expressed by users of such equipment.

Before describing the operation of this filter, it is well to consider briefly the principles upon which it operates. According to the experiments of this company, the ideal conditions for a filter would be:

(1) Filtering performed by the solid matter in the liquid filtered.

(2) The layer of this solid matter must be constant and therefore must be constantly removed without exposing the bare surface of the screen or filtering device.

(3) The solid material should leave the filter with but a small percentage of moisture—dry if possible.

To include all of these conditions it was found that the liquid to be filtered must be mixed with a porous substance such as Filter-Cel, sawdust, short-fiber asbestos, paper pulp, bagasse, beet pulp, etc.; in short, with a material which is suitable and convenient for the liquid to be filtered. If the liquid to be filtered has already enough solids, the addition of foreign material is unnecessary. It is impossible to treat all the different liquids alike. Each liquid must be prepared to suit its physical condition. It is, of course, impossible to lay down fixed rules to be adhered to, as different liquids and materials require different treatments. If the solids to be removed are of a slimy nature (waterproof) or are in a small quantity, as stated before, the liquid has to be mixed with a foreign suitable solid to form a cake through which the filtration or separation takes place.

In describing the operation of the filter, it is supposed that the liquid to be filtered is properly prepared with the solids in sufficient quantity and quality, kept agitated in a mixer placed above the filter.

The upper part of the filter consists of a cylinder ending in a short cone which rests on a number of bars placed radially inside of a shell which rests on a saddle, permitting the escape of the filtrate into a surrounding basin. This saddle also supports the bars. The central hole of the saddle corresponds with a hole in the center of the basin and is closed by a conical plug operated by hydraulic pressure by means of a pneumatic accumulator. The liquid to be removed from the sediments has to travel only a short distance horizontally to find its outlet at the edges of the cakes toward the bars.

The displacement center is continued upward into the mixer (not shown in the illustration). A reciprocating plunger (not shown) is placed in the mixer and passes up and down into the upper cylinder to the beginning of the short cone. The plunger when rising above the cylinder allows the liquid and material to be filtered to flow into the cylinder and it is forced by the return stroke through the solids compressed in space between bars and center, from where it flows through the minute slots between the bars into the lower basin. As gradually more and more solids are pumped into the filter the pressure in the filter gradually increases until it counteracts the hydraulic valve pressure, the valve will open and some solids slide out, when the valve will close or partly close again according to conditions.

With each stroke of the plunger a new cake is formed, which forces the previous cake down without adding more sediment to its surface; in fact, the surface of each cake is covered only with the sediment contained in the liquid delivered by each stroke of the plunger, and therefore its filtering capacity remains constant.

Another feature claimed for the filter is the cleaning effect of the downwardly sliding cakes on the bars, which never become clogged. An important function is performed by the cone shape just below the cylinder at top of filter. It contains compressed sediments which would follow the plunger on its up stroke but are prevented by the conical shape. The displacement center not only decreases the distance of flow of the liquid to the outlet between the bars but also facilitates the breaking of the cake for discharging, as the

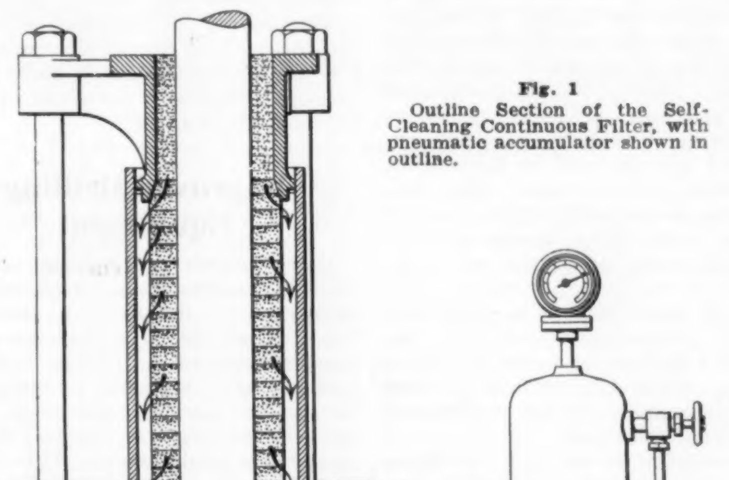


Fig. 1
Outline Section of the Self-Cleaning Continuous Filter, with pneumatic accumulator shown in outline.

conical plug valve will easily force its way into the center hole of the ring-shaped cake, expand it and thereby break it.

From the design of this filter it will be observed that a practically unlimited pressure may be used in its operation. The only limit is the strength of the shell. The bars cannot be distorted, as they rest on each other sideways and against the shell. Another striking feature is the complete absence of screens, cloth, scrapers and rotating or moving parts with all the limitations these might imply.

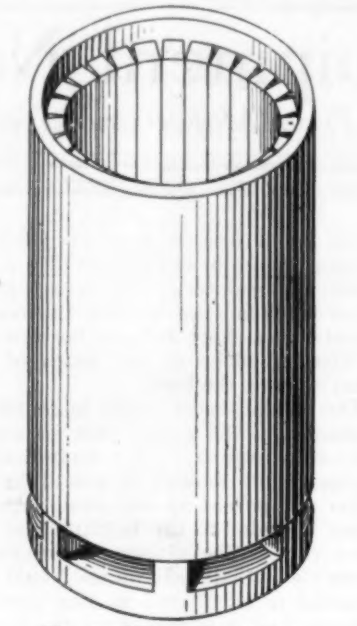


Fig. 2—Filtering Cylinder
Detail showing lining of bars in position.

Novel Method of Plant Heating

Plants situated in a locality where there is a plentiful and cheap supply of electric current and the electric system's load factor is low will be interested in the plant heating method adopted by the Ford Motor Co., Green Island, N. Y. This factory is heated by hot water which is heated in an electric steam boiler.

The building is 1,140 ft. long, 120 ft. wide, and consists of three bays, the two side bays being about 20 ft. in height and the central bay about 35 ft. in height. The outer exposure of this building consists of about 50 per cent of glass; 65,000 sq.ft. of radiation is installed. Water is circulated by motor-driven centrifugal pumps at the rate of 1,500 gal. per minute, and at a pressure of about 40 lb. The water is circulated through one or two electric heaters, depending upon weather conditions, and is raised in temperature from 135 deg. F. to about 153 deg. F. The heaters are of the electrode or water resistance type, having a capacity of 3,200 kw. each, and are operated at 4,600 volts, three phase, sixty cycles. The electrical input is controlled by the level of the water in the boiler exactly as in the case of a steam generator and independent of the pump pressure. The change of water level is accomplished by an air column in the heaters, the length of which can be varied at will by admitting or releasing air. Air for this purpose is supplied by the compressed air system of the plant.

The control of power input is, therefore, extremely simple and could be accomplished by thermostatic attachment if desired; but inasmuch as the boilers or heaters operate very steadily and it is necessary only to change the power input according to outdoor temperature, thermostatic control is hardly worth while. Each heater occupies a floor space only 4 ft. square and a surge tank occupying an equal amount of floor space is required in order to avoid waste of water when the load on the heaters is reduced; thus only a small amount of water need be added occasionally to make up for leakages from the system.

The advantages of electric heating are absolute cleanliness, minimum of space required and perfect efficiency. No separate heating plant is required, no fuel storage, ash handling or labor. The heaters require only occasional attention by a janitor or other attendant who also looks after the circulating pumps and other duties. The cost of the installation is very low as compared with the cost of fuel-fired equipment of equal capacity and the cost of operation often is almost literally nothing when the electric heaters or boilers can be put in charge of a regular boiler-room crew. The equipment for this heating system is made by the Electric Furnace Construction Co., Philadelphia, Pa.

Improved Drilling Equipment

Improvements in the design of portable air compressors and rock drills are announced by the Sullivan Machinery Co., Chicago, Ill., a well-known equipment manufacturer in this field. The portable air compressor in question is the gasoline engine-driven model. This has been increased in size to 170 cu.ft. per minute displacement. This enables users to operate two "Rotator" hammer drills at 100 lb. pressure simultaneously to 14 ft. depth if desired. A new transmission has been provided, consisting of a simple and substantial gear reduction. The four-cylinder, four-cycle Buda engine is retained, the compressor requiring 31 hp. to operate and this engine giving a safe power margin. The new differential valve water drifting drill, "DW-64," is a 130-lb. machine. It may be operated by one man if desired, but is intended for heavy as well as light work. In actual practice it is claimed that it has proved capable of handling long holes and heavy steel, in all kinds of ground, with increased drilling speed, convenience and air economy, as compared with two-man drills weighing 40 to 100 lb. more.

Catalogs Received

FOAMITE-CHILDS CORPORATION, Utica, N. Y.—A booklet entitled "The Essentials of Self-Protection Against Fire," which gives much interesting information on fire extinguishers in general and Foamite-Childs extinguishers in particular.

AMERICAN ARCH CO., INC., 17 E. 42nd St., New York, N. Y.—Bulletin 103. A new bulletin describing the American Suspended Arch, a firebox arch for boiler settings.

KALBFLEISCH CORPORATION, 200 Fifth Ave., New York, N. Y.—A new catalog, describing the chemicals sold by this company and containing much general information of value to users of heavy chemicals.

TABER PUMP CO., Buffalo, N. Y.—A folder describing the Taber Boiler Compound Feeder, an apparatus for feeding softening reagents or boiler compounds to feed water in a consistent manner.

C. F. PEASE CO., 852 N. Franklin St., Chicago, Ill.—Catalog M23. A new catalog showing in detail the complete line of blue-printing machinery, blueprinting accessories and drafting room suppliés made by this concern, with prices as of Oct. 1, 1923.

F. J. RYAN & CO., Philadelphia, Pa.—Bulletin 2A. A folder on the new "Mircs" oil-fired portable rivet heating furnace.

CHEMICAL CONSTRUCTION CO., Charlotte, N. C.—Catalog 5. A catalog describing and showing by photographs the system for the recovery of separated acid sludge designed and installed by this comany.

YORK MANUFACTURING CO., York, Pa. Bulletin 70.—A folder describing the York self-contained refrigerating units, which are sized unit plants adapted to use in industries where only a limited quantity of cold is needed.

U. S. GALVANIZING & PLATING EQUIPMENT CORPORATION, 32 Stockton St., Brooklyn, N. Y.—A folder describing the U. S. Moving Cathode Plating Apparatus and giving examples of its use by leading manufacturers of plated articles.

THE FOXBORO CO., INC., Foxboro, Mass. Bulletin 162. A folder describing the Foxboro Recorder-Controller for obtaining temperature control and a temperature record from the same apparatus, also describing some of the uses of this equipment.

STREAMLINE FILTER CORPORATION, 95 Liberty St., New York, N. Y.—A catalog describing Dr. Hele-Shaw's streamline filter—now introduced for the first time in this country.

FULLER-LEHIGH CO., Fullerton, Pa.—Bulletin 900. A catalog entitled "Pulverized Coal for Boilers," which describes the system of firing by pulverized coal which is installed by this company.

SULLIVAN MACHINERY CO., Chicago, Ill.—Form 1592. A catalog describing the Class "WK-311" portable gasoline engine-driven air compressor, which at 450 r.p.m. with an input of 31 hp. has a displacement of 170 cu.ft. per minute.

THE PFAUDLER CO., Rochester, N. Y.—New illustrated catalog describing the complete line of glass-lined steel equipment for the chemical and allied industries which this concern makes. Numerous pictures from actual illustrations of Pfaudler equipment are a feature.

DE LAVAL STEAM TURBINE CO., Trenton, N. J.—A booklet entitled "Efficiency Tests of De Laval Motor-Driven Pumps," which gives the results of tests of several large units. In sizes ranging from 300 to 1,500 hp. each, these centrifugal pumps showed overall efficienies, including the motor, from overall efficiencies, including the motor, from 75 to 82.5 per cent.

COMBUSTION ENGINEERING CORP., 43 Broad St., New York City.—A pamphlet describing the new "Frederick" multiple-retort, underfeed stoker. This stoker is already in operation in a number of representative power houses and the results obtained have been satisfactory.

THE CALORIZING CO., Oliver Building, Pittsburgh, Pa.—A book entitled "Preventable Losses in Oil Refining," which tells what calorizing is and describes how, by its use, the four losses of oxidation, coke deposit, carburization and corrosion in oil refineries may be lessened.

MCMYLER-INTERSTATE CO., Cleveland, O.—Folder entitled "There's a Way to Cut Your Costs" which describes the new convertiole type McMyler-Interstate locomotive crane, which may be used as crawler, tractor or railroad crane, may be operated by steam, gasoline or electricity and may be converted from crane to steam shovel.

Review of Recent Patents

Tunnel Kiln Construction

Several Unusual Designs Show Interest Manifested in This Type of Furnace for Continuous Heating of Various Materials

TUNNEL kilns are of two general types: (1) those in which the wares to be fired (or their inclosing receptacles or saggers) are exposed to direct contact with the flames or with the hot fire gases or products of combustion, such kilns being commonly used for the firing of earthenware or porcelain, and for the firing of bricks or the like, and for other similar purposes; and (2) those of the type of muffle furnaces in which the tunnel chamber is formed with a lining or shell which is heated externally by the gases of combustion, and through which the heat is transmitted to the wares or their receptacles carried on the cars so that the wares or receptacles are not exposed to direct contact with fire gases.

Some interesting construction details adapted particularly to the latter or muffle type kiln are given by Louis A. White of Metuchen, N. J., in Patent 1,471,875, granted Oct. 23, 1923.

In either type of tunnel kiln it is customary to divide the length of the tunnel into three zones, viz.: (1) a heating-up zone in traversing which the carloads of wares to be treated are exposed to the heat of the waste fire gases, and are thereby gradually heated up as they progress toward the zone of highest temperature; (2) the firing zone, or zone of highest temperature, where the heat-treatment is accomplished and which approximately coincides with the zone in which the combustion of fuel takes place; and (3) the cooling-off zone, in which the wares as they progress away from the firing zone are gradually cooled, their heat being commonly economized by being used to pre-heat the entering air which is to support the combustion.

The principal object of the present invention is to provide for the more effective control or grading of the temperature longitudinally of the furnace throughout the firing zone. Heretofore in tunnel kilns the heat has been generated in combustion chambers extending longitudinally of the tunnel, and in chambers thus located it is impossible to accomplish any close regulation or grading of the temperature, because the burning gases or flames travel in a longitudinal direction. Attempts to control the combustion by introducing thereto fuel at successive longitudinal points in such combustion chambers have been only partly successful. According to the present invention heat is generated in a series of distinct combustion chambers arranged transversely of the tunnel, and in each of which the combustion is regulated independently of the others. Any desired number of such combustion chambers may be provided according to the desired length of the firing zone.

By this means any desired heating effect may be obtained, the greatest heat being imparted either at the beginning, middle or end of the firing zone, or a level temperature being maintained throughout such zone, as may be required for any particular service; or the firing zone may be lengthened or shortened by throwing one or more of the combustion chambers into or out of service.

Another important object of his invention is to provide means for more effectively utilizing the heat of the waste fire gases for preliminary heating up of the wares to be treated; and for more effectively accomplishing the cooling off of the treated wares and utilizing the heat radiated therefrom for the heating of air for supporting combustion, or for other uses. To these ends flues are provided between the muffle or tunnel lining and the masonry structure of the kiln, in which the air or gas is caused to flow repeatedly back and forth across the roof of the tunnel and against the sides thereof.

The main masonry structure of the kiln comprises side walls and an arched roof. The arch is larger than the tunnel chamber, the spare between serving for combustion chambers and flues for preheating air and also ware. The tunnel chamber is formed of relatively thin refractory tiles so as to permit efficient heat interchange. General arrangement of the flues over the tunnel chamber is as indicated in Fig. 1. Air for combustion enters ports 35 and passes through flues L, L to baffled flues L', L', where heat is absorbed from the cooling ware. The preheated air is then divided between trunk flues, m, m, which feed the burners. It will be noted that there are a number of combustion chambers J, J so that temperature can be controlled with ease. Products of combustion pass up through the vertical portion of the combustion chamber and follow the arch over the top of the tunnel chamber. They then pass horizontally through the baffled flues N, N, giving up heat to the incoming ware. The lower portion of Fig. 1 shows the main K, which distributes gas to the burners, and at the right a system of pipes for removing more heat from the cooling ware, since all of the available heat is not required for preheating air for combustion.

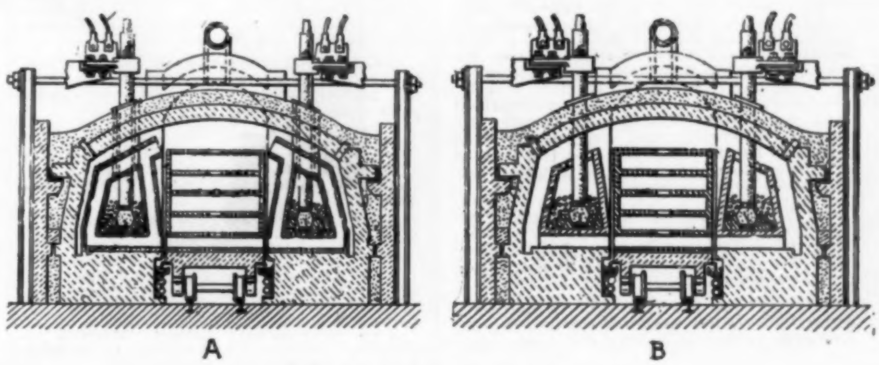


Fig. 2—Granular Resistance Element

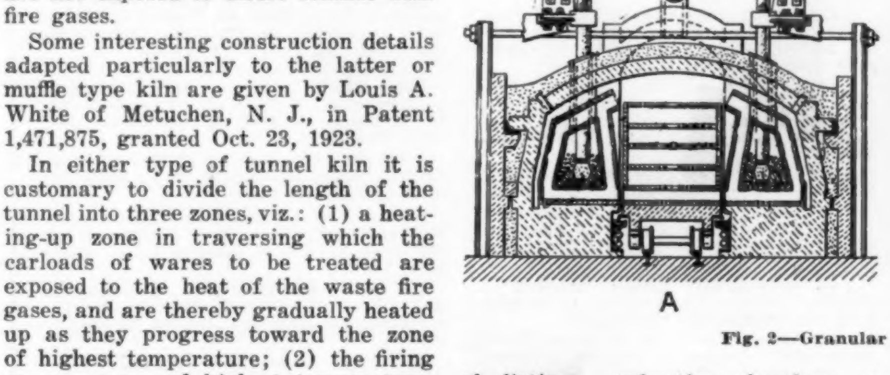


Fig. 1—Heat Exchange in Tunnel Kiln

Electrically Heated Kiln

Fig. 2 illustrates a method for heating kilns by electricity in order to obtain more exact control of temperature conditions. It is described by George H. Benjamin, of New York, in Patent 1,474,616, granted Nov. 20, 1923.

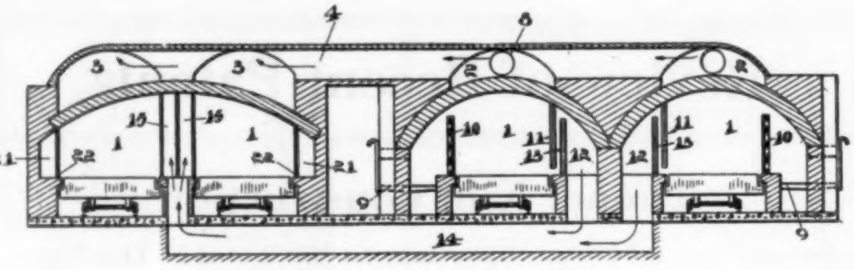


Fig. 3—Double Tunnel Kiln

Two types of heating chamber are shown: at *A*, the walls are single with openings at the top for electrodes, while in *B* the walls are double with openings at top and bottom in addition to that necessary for the electrode. *A* also represents open kiln construction, since the heating chamber is open in the kiln, while in *B* a sleeve protects the electrodes and carries any gases out of the kiln. The heating element consists of a block of high-resistance material supported between two blocks of refractory carbon, the whole being surrounded with lump carbon into which the electrodes project. There are two electrodes connected in multiple in each heating chamber.

Double Tunnel Kiln

An unusual design of double tunnel kiln in which the preheating zone is alongside instead of in alignment with the main part of the kiln is shown in Fig. 3. It is described by George W. Booth, of Islington, Ont., Canada, in Patent 1,474,063, granted Nov. 13, 1923.

In the walls of the cooling zone and firing zone of the kiln is formed an air space 2, preferably extending from end to end thereof at the top of the kiln so that the air passing therethrough takes up heat from the upper parts of the kiln. A similar air space 3 extends along the pre-heating zone of the kiln and is connected by the transverse flue 4 with the air space 2. In the walls of the cooling zone of the kiln are also formed air spaces, preferably extending from end to end thereof, and connected at intervals with the air space 2 by air passages controlled by dampers. From openings at the exit end of the kiln outside air is admitted.

American Patents Issued December 18, 1923

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers interests, and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,477,538—Method of and Apparatus for Welding Metals. Glenn O. Carter, New Rochelle, and Raymond C. Pierce, New York, N. Y., assignors to the Linde Air Products Co.

1,477,629 — Electrolytic Apparatus. Russell K. Chrisman, Syracuse, N. Y., assignor to Semet-Solvay Company, Solvay, N. Y.

1,477,635—Process of Forming Composite Lubricants. Dempsey Kemp Dodge, Houston, Tex.

1,477,638—Incinerator. Joseph Feigenbaum, Los Angeles, Calif., assignor to Safety Concrete Incinerator Co., Inc., Los Angeles.

1,477,663—Process for Surfacing Clay Products. Emmett V. Poston, Springfield, Ill., assignor to Poston Brick Co., Springfield, Ill.

1,477,664—Process of and Apparatus for Treating Materials. Harry D. Rankin, Coronado, Calif.

1,477,671—Artificial Fuel and Process for Making the Same. Charles F. Staudenmayer, Baltimore, Md.

1,477,673—Collecting Main for Coke Ovens. Larkin Suber and Elbert Mercer, East Youngstown, Ohio.

1,477,675 — Continuous Tunnel Kiln. Laurence Arthur Vincent, Pleasantville, Pa., assignor to American Dressler Tunnel Kilns, Inc., Cleveland, Ohio.

1,477,682 — Convertible Drying Kiln and Crib. George W. Atherton, Livermore, Ky.

1,477,703 — Process of Coating and Treating Materials. Joseph L. Herman, Peoria, Ill.

1,477,710 — Means and Method for Operating Combustion Engines From Gas Derived From Calcium Carbide. Roy J. Meyers, Long Beach, Calif., assignor to International Gas, Power & Appliance Co., Long Beach.

1,477,757—Zeolite and Process of Preparing Same. Walter J. Hughes and Abraham S. Behrman, Chicago, Ill., assignors to International Filter Co., Chicago.

1,477,795 — Shipping Container for Liquids and Method of Making Same. Lester Marius White, Perth Amboy, N. J., assignor to Perth Amboy Chemical Works, New York.

1,477,803—Thiocarbanilide Derivative. Clayton W. Bedford and Robert L. Sibley, Akron, Ohio, assignors to the Goodyear Tire & Rubber Co., Akron.

1,477,805 — Accelerator for the Vulcanization of Caoutchouc Substances. Clayton W. Bedford, Akron, Ohio., assignor to Goodyear Tire & Rubber Co., Akron.

1,477,810—Process for Manufacturing New and Improved High Refractory. Charles James Crawford, St. Louis, Mo.

1,477,821 — Electric Melting Furnace. Alfred W. Gregg, Chicago, Ill., assignor to Whiting Corporation, Harvey, Ill.

1,477,823—Rotary Drier. Aubrey J. Grindle, Chicago, Ill., assignor to Grindle Fuel Equipment Co., Harvey, Ill.

1,477,824 — Powdered-Material-Firing Apparatus. Aubrey J. Grindle, Chicago, Ill., assignor to Grindle Fuel Equipment Co., Harvey, Ill.

1,477,837—Continuous Kiln. Fritz Mayer, Nuremberg, Germany, assignor to Berta Stoerzer, Brooklyn, N. Y.

1,477,849—Spiral Separator and Method of Separating Materials. Frank Pardee, Hazleton, Pa., assignor to Anthracite Separator Co.

1,477,860 — Oil-Converting Apparatus for the Conversion and Transformation of Oils. Joseph H. Adams, Flatbush, N. Y., assignor to the Texas Company, Houston, Tex.

1,477,870—Artificial Resin and Method of Preparation. Carleton Ellis, Montclair, N. J.

1,477,879—System of Control for Vulcanizers. Karl B. Kilborn and Walter E. Shively, Akron, Ohio, assignors to the Goodyear Tire & Rubber Co., Akron.

1,477,922 — Treating Magnesium and Alloys Comprising the Same. Emil Wollner, Schwanheim-on-the-Main, and Felix Thomas, Frankfort-on-the-Main, Germany, assignors to the Firm, Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany.

1,477,938—Fluid Composition for Compounding, Impregnating, and Coating. Reginald Percy Leopold Britton, London, England, assignor to Griffiths Bros. & Company, London Limited, London.

1,477,951 — Method of Regenerating Mercury Catalyst. Nathan Grünstein, Frankfort-on-the-Main, Germany.

1,477,965 — Process of Making Solutions Containing Sulphuric Acid and Ferric Sulphate. Edmund S. Leaver, Tucson, Ariz., assignor of one-third to Charles E. van Barneveld, St. Louis, Mo., and one-third to Lawrence R. Eckman, Tucson, Ariz.

1,477,986—Filtering Apparatus. Burchard Thoens, New York, N. Y., assignor of one-half to Emile J. Météric, East Orange, N. J.

1,478,015 — Production of Triphenylmethane Dye. Don W. Bissell, Buffalo, N. Y., assignor to National Aniline & Chemical Co., Inc., New York.

1,478,027 — Production of Vat Dyestuffs. Lloyd C. Daniels and Winthrop S. Lawrence, Buffalo, N. Y., assignors to National Aniline & Chemical Co., Inc., New York.

1,478,036—Purification of Gases. Roy Griffith Jones, Bloomfield, N. J., assignor to Westinghouse Lamp Co.

1,478,039—Triarylmethane Dyes. Lucas P. Kyrides, Buffalo, N. Y., assignor to National Aniline & Chemical Co., Inc., New York.

1,478,061—Vat Dye. Donald G. Rogers and Harold T. Stowell, Buffalo, N. Y., assignors to National Aniline & Chemical Co., Inc., New York.

1,478,062—Degasifying Agent. William A. Scheuch, East Orange, N. J., assignor to Western Electric Co., Inc., New York.

1,478,088—Method of Vulcanizing Rubber. Herbert A. Winkelmann and Harold Gray, Akron, Ohio, assignors to the B. F. Goodrich Co., New York.

1,478,137 — Manufacture of Cellulose Acetates. Walter Nebel, Sioux City, Iowa.

1,478,180—Process for Extracting Sulphur From Spent Oxide From Gas Plants. Arthur Given, Newark, N. J., assignor to Stevens, Aylsworth Co., New York.

1,478,186 — Evaporating Apparatus. Willis A. Swan, Port Huron, Mich.

1,478,206—Apparatus for Condensing Distilled Vapors. Gaston de Béthune, Brussels, Belgium.

1,478,247—Report for Destructive Evolution and Oxidation. Clarence F. Ott, Whittier, Calif.

1,478,337—Method of Treating Solutions to Obtain Solid Constituents Thereof Separated in a Coarse Condition. Isak Isaachsen, Christiania, Norway, assignor to A/S De Norske Saltverker, Bergen, Norway.

1,478,340—Electrolytic Cell for Generating Oxygen and Hydrogen. Isaac H. Levin, New York, N. Y.

1,478,347 — Apparatus for Calcining Lithopone. John L. Mitchell, Greenwich, Conn.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

A baffle wall 10 extends up nearly to the roof of the tunnel, and is preferably formed of checker work in a well known manner. This wall serves to distribute the products of combustion in a satisfactory manner from top to bottom of the tunnel. Each part of the kiln opposite the furnace is provided with a wall 11 forming a flue 12 communicating with the interior of the tunnel at its lower side.

A baffle wall 13 may be provided inside this flue 12 to cause the hot products of combustion to travel up against the inner side of the wall 11, so as to maintain it in a sufficiently heated condition to radiate heat into the interior of the tunnel, thus assisting in maintaining equality of temperature at all parts of the interior of the firing zone.

Readers' Views

Group *vs.* Individual Credit for Research Achievements

To the Editor of Chem. & Met.:

SIR—In writing the note which appears on page 785 of your issue of Oct. 29, 1923, you are clearly under the impression that our practice of publishing papers in the name of the whole staff is imposed on us by our employers. We hasten to assure you that you are completely mistaken. It is a practice which we chose ourselves as the result of thorough discussion. It is a policy voted by a democracy, not dictated by an autocracy.

Our reasons for adopting the policy are two:

1. Our method is an expression of a definite fact—namely, that we are so closely associated in our work that nothing we produce can be assigned to a single individual or to anything less than the whole staff.

2. We find a much more powerful incentive in the good opinion of our colleagues, who are in the position to judge the value of our work, than in a "reputation" among outsiders, whose judgment can never be based upon adequate knowledge. Even in applying for other posts, we think that a testimonial from our colleagues, unbiased by the jealousy which must inevitably attend an attempt to gain independent external reputations, is the most valuable recommendation that we could possible have.

(Signed)

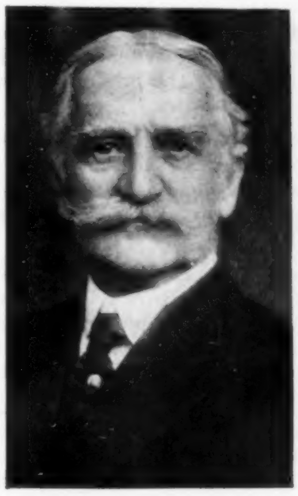
A. C. BARTLETT, NORMAN E. CAMPBELL, BERNARD P. DUDDING, CHRISTOPHER G. EDEN, E. M. EDEN, L. D. GOLDSMITH, B. S. GOSSLING, FREDERICK S. GOUCHER, R. HUDDART, L. B. W. JOLLEY, W. G. LLEWELLYN, G. C. MORRIS, C. C. PATERSON, R. LEROSSIGNOL, J. A. RYDE, R. W. W. SANDERSON, WILLIAM SINGLETON, C. J. SMITHELLS, M. THOMPSON.

Research Laboratories,
General Electric Co., Ltd.,
Wembley, England.

Obituary

Samuel Philip Sadtler died at his home in Philadelphia on Dec. 20, 1923. His death, at the age of 76, was the result of an operation performed after a comparatively short illness. Thus was the curtain drawn on a busy, active life that had had its influence on practically every phase of industrial chemistry and chemical engineering in this country.

Dr. Sadtler was an eminent professor of chemistry, a noted consulting chemist, a distinguished author and writer of chemical literature, and a fearless leader in many other lines of chemical endeavor.



Samuel P. Sadtler

One of Professor Sadtler's closest associates has said of him: "He was a tireless worker, modest to a fault and yet exceedingly well posted on all advances made in the general as well as the industrial fields of chemistry. Personally he was a most kind, considerate and tactful man. Never in my experience have I been associated with anyone possessed of such an ideal character."

Professor Sadtler was born at Pine Grove, Pa., July 18, 1847, the son of the Rev. Benjamin S. Sadtler. After graduating from Pennsylvania College at Gettysburg in 1867 he studied at Lehigh and then at Harvard. It was from the latter institution that he received the degree of Bachelor of Science in 1870, the same year that Pennsylvania College granted him the degree of Master of Arts. His work for his doctorate, which was under Professor Wöhler at Göttingen, was completed in 1871. On his return to this country he was appointed professor of chemistry at Pennsylvania College, holding this position until 1874, when he resigned to become professor of general and organic chemistry at the University of Pennsylvania.

In 1902 Pennsylvania College, from which he had been graduated 35 years before, conferred upon him the honorary degree of Doctor of Laws.

Early in Professor Sadtler's professional career he was offered a highly remunerative position as chief chemist for an industrial concern which was the largest of its kind in the world. He refused it simply because he had "found his happiness in teaching." Yet his interest in his consulting work never lagged. Particularly stimulating were the many important patent suits in which he figured so prominently. Beginning with the celebrated Demarrero sugar case in Baltimore in 1875, the long list of important suits includes such litigation as the defense of the Schultz chrome tannage patent, the adrenalin case, the calcium carbide suit, the casein litigation and the series of cases defending the Dubbs patents for cracking petroleum.

Professor Sadtler's connection with the Philadelphia College of Pharmacy dates from 1878, when he first appeared as a lecturer in chemistry and later, on the death of Prof. Henry Trimble, was appointed professor of analytical chemistry. He gave up his professorship at Pennsylvania in 1891 in order to give more of his time to the college of pharmacy and to his growing consulting practice. This arrangement obtained until 1916, when he retired from active teaching and was made professor emeritus of chemistry and elected to the board of trustees of the Philadelphia College of Pharmacy.

Three times, in 1890, 1900 and 1910, Professor Sadtler served on the committee charged with the decennial revision of the United States Pharmacopœia. For 36 years—from 1880 to 1916—he was the chemical editor of the United States Dispensatory, that tremendous compilation of medical, pharmaceutical and chemical data. His first book was a "Handbook of Chemical Experimentation for Lecturers and Teachers," written in 1877. His work best known to the chemical engineer is his famous text-book on "Industrial Organic Chemistry," the first edition of which appeared in 1891. It has since gone through five editions, the last revision appearing during the past year under the joint authorship of Dr. Sadtler and Dr. Louis J. Matos.

When the American Institute of Chemical Engineers was formally organized in Philadelphia in June, 1908, Professor Sadtler was elected its first president. He was re-elected at the Pittsburgh meeting Dec. 28, 1908, and served until the second annual meeting, Dec. 8, 1909. He was a fellow in the American Academy of Science, a member of the American Chemical Society, the American Electrochemical Society, the Chemical Society of London, the Society of Chemical Industry, the Chem-

ische Gesellschaft, the American Philosophical Society, the American Pharmaceutical Association, the Franklin Institute, the Engineers' Club and University Club of Philadelphia and the Chemists' Club of New York.

Professor Sadtler is survived by two daughters and two sons. One of the sons, Samuel Schmucker Sadtler, has long been associated with his father in the consulting firm of Samuel P. Sadtler & Son of Philadelphia.

Men in the Profession

Dr. L. H. BAEKELAND has been elected president of the American Chemical Society for the coming year. HENRY P. TALBOT and GEORGE D. ROSENGARTEN were elected directors; CHARLES A. BROWNE, HARRY N. HOLMES, LAUDER W. JONES and HARLAN S. MINER, councilors-at-large.

R. C. BECKETT, a graduate of the Pennsylvania State College and engaged as an industrial chemist for a number of years, was appointed State Sanitary Engineer of Delaware at a meeting of the Delaware State Health and Welfare Commission, Dec. 18.

Dr. REINHARD BEUTNER, formerly with Rockefeller Institute for Medical Research and later at the University of Leyden, Holland, is now with the Combustion Utilities Corporation at its laboratories at Long Island City, N. Y.

E. COWAN of Fort William, Ont., has been appointed mill engineer for the St. Lawrence Pulp & Paper Co., Three Rivers, Que.

J. F. CULBERTSON has been elected president of the Independent Oil Co., Allentown, Pa.

H. E. DILLER, of Cleveland, addressed the Buffalo branch of the American Society of Mechanical Engineers at the Hotel Statler, Dec. 17, on the subject "Modern Foundry Practice."

Dr. JACOB DOLID, who received the degree of Ph.D. from McGill University last spring, is now associated as a research chemist with the Combustion Utilities Corporation at Long Island City, N. Y.

Dr. H. C. HOWARD, formerly research chemist on the staff of the B. F. Goodrich Co., is now assistant professor of chemistry at the University of Missouri.

C. L. HUSKING of New York was a recent visitor in Washington. He visited several of the bureaus engaged in chemical activities.

D. C. JACKSON, sugar chemist, heretofore located at the beet sugar mill at Longmont, Colo., has become head chemist for the Central Francisco Sugar Co., in Cuba.

Prof. CHARLES A. KRAUS, professor of chemistry at Brown University, was selected as the recipient of the Nichols medal for the current year by the Nichols medal committee, meeting on Dec. 18.

JAMES C. LAWRENCE, who has been operating an oil-recovery plant at Chester, Pa., is now with the dye division of E. I. du Pont de Nemours & Co., at Wilmington, Del.

Dr. LANDON C. MOORE of Dallas, Tex., gave an interesting talk before the Dallas Technical Club, Dec. 18, on the subject "The Evolution of the Cottonseed Industry."

EDGAR PALMER, president of the New Jersey Zinc Co., New York, accompanied by J. E. Hayes, vice-president, and W. P. Hardenbergh, treasurer, has concluded a visit of inspection of a number of days at the company plant at Palmerton, Pa.

C. D. PORCH, superintendent of the dye works of E. I. du Pont de Nemours & Co., Wilmington, Del., has been elected chairman of the Delaware Section of the American Chemical Society for the ensuing year. Other officers chosen were: H. V. BERG, vice-chairman; E. M. SYMMES, secretary, and J. LEROY BENNETT, treasurer. Dr. CHARLES L. REESE and C. M. STINE were elected councilors.

J. B. SEGUR, formerly an instructor at the Georgia School of Technology, Atlanta, Ga., is now associated as a research chemist with the Combustion Utilities Corporation at Long Island City, N. Y.

R. R. STEVENSON has become general manager of the New Kensington, Pa., plant of the Aluminum Co. of America. He has heretofore acted as assistant superintendent at the mill.

A. E. TYLER, Canadian manager of the Crucible Steel Co., Montreal, is now convalescent at his home after an illness of a month.

ROBERT A. WORLEY, who recently left the Charleston, S. C., refinery of the Standard Oil Co. of New Jersey, is now in the chemical department of The Barrett Co., at Frankford, Pa.

Calendar

AMERICAN CERAMIC SOCIETY, Atlantic City, N. J., Feb. 4 to 9.

AMERICAN CHEMICAL SOCIETY, regular meeting, Rumford Hall, Chemists' Club, New York, Jan. 4.

AMERICAN CONCRETE INSTITUTE, annual meeting, Chicago, Feb. 25 to 28.

AMERICAN ENGINEERING COUNCIL of the Federated American Engineering Societies, Washington, D. C., Jan. 8 to 11.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, New York City, Feb. 18 to 21.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, annual meeting, New York City, Jan. 22 to 25.

AMERICAN SOCIETY OF SAFETY ENGINEERS, annual meeting, New York City, Jan. 18.

AMERICAN SOCIETY FOR STEEL TREATING, winter sectional meeting, Hotel Seneca, Rochester, N. Y., Jan. 31 and Feb. 1.

CANADIAN NATIONAL CLAY PRODUCTS ASSOCIATION, Prince George Hotel, Toronto, Ont., Feb. 13 and 14.

COMMON BRICK MANUFACTURERS' ASSOCIATION, Biltmore Hotel, Los Angeles, Calif., Feb. 11 to 14.

ENGINEERING INSTITUTE OF CANADA, annual general meeting, Montreal, Jan. 22, and Ottawa, Jan. 23 and 24.

FRANKLIN INSTITUTE, annual meeting, Philadelphia, Jan. 16.

SOCIETY OF AUTOMOTIVE ENGINEERS, annual meeting, simultaneously with the Detroit Automobile Show, General Motors Bldg., Detroit, Mich., Jan. 22 to 25.

SOCIETY OF CHEMICAL INDUSTRY, Perkin medal award, Rumford Hall, Chemists' Club, New York, Jan. 11.

Important Articles in Current Literature

More than fifty industrial, technical or scientific periodicals and trade papers are reviewed regularly by the staff of *Chem. & Met.* The articles listed below have been selected from these publications because they represent the most conspicuous themes in contemporary literature, and consequently should be of considerable interest to our readers. A brief résumé of each article is included in the reference given. Since it is frequently impossible to prepare a satisfactory abstract of an article, this list will enable our readers to keep abreast of current literature and direct their reading to advantage. The magazines reviewed have all been received within a fortnight of our publication date.

REPORT ON STOKER-FIRED KILN TEST. Cost data covering a test of the Gates kiln stoker made in direct competition with hand-firing methods at the Laclede plant of the Laclede-Christy Clay Products Co., St. Louis, Mo. *Brick & Clay Record*. Dec. 11, 1923, pp. 836-840.

HOW GOOD SILICA BRICK ARE MADE. *E. E. Ayars*. Fifth and concluding installment of a very comprehensive series covering practical suggestions on silica brick manufacture. The author has had extended experience as superintendent of a large silica brick plant and accordingly writes with authority. *Brick & Clay Record*, Dec. 11, 1923, pp. 847-852.

NEW USES FOR RUBBER LATEX. *G. I. Ramsig*. A résumé of the latest developments in the use of this material to replace many articles now made of other material. *Rubber Age*, Dec. 10, 1923, pp. 170-2.

LOW-TEMPERATURE TAR FROM BITUMINOUS COAL. *J. J. Morgan*. Extending the study of tar from the Carbocoal process made in Fuel Research Laboratory, department of chemical engineering, Columbia University. *Chem. & Ind.*, Dec. 7, 1923, pp. 1178-82.

OIL-REFINING METHODS REVIEWED. *W. A. P. Schorman*, chief chemist, British-American Oil Co. Abstract of address and pertinent discussion before Toronto section, Soc. of Chem. Ind., *Canadian Chem. & Met.*, December, 1923, p. 315.

ALUM, AN AID TO THE FILTRATION OF ACTIVATED SLUDGE. An abstract of the paper by *Dr. F. W. Mohlman*, chief chemist, Sanitary District of Chicago, before A.C.S. at Milwaukee. *Eng. News-Record, Dec.* 20, 1923, pp. 1015-6.

GRAPHITE FOR STEEL-MELTING CRUCIBLES. A report of tests made by the Bureau of Mines on American graphite in competition with that from Ceylon and Canada. *Iron Age*, Dec. 20, 1923, pp. 1664-65.

THE PROBLEM OF CORROSION IN THE COAL-MINING INDUSTRY. *George M. Enos*. A study of the prevention of corrosion by acid mine waters. *Proceedings of the Engineers Society of Western Pennsylvania*, December, 1923, pp. 309-327.

News of the Industry

Summary of the Week

Imports of chemicals and allied products show sharp decline in November.

Reparation dyes reported to be reaching this country from Italy.

Smugglers make regular business of bringing in fine chemicals, dyes and pharmaceuticals.

Domestic production of acetate of lime and methanol increased in October.

Spot supplies of phenol were limited and higher prices prevail in consequence.

Expansion throughout glass industry seen in projects under way for 1924.

Italian army begins active study of war gases.

Generators may be used instead of airplanes in applying calcium arsenate to cotton fields.

Kraus selected to receive Nichols medal for work done on conductance.

New Jersey Clay Workers hold live meeting at New Brunswick discussing refractories, feldspar, flint and clay formation.

Fine Chemicals and Concentrated Dyes Smuggled Into This Country

Illegal Traffic Becomes a Regular Business—Is Conducted in Connection With Liquor Running—Boats From Foreign Ports Carry Return Cargoes

SMUGGLING has become a regular business. It has reached a point where boats engaged in that activity have arranged for return cargoes. Tobacco and other commodities subject to import duties and excise taxes in other countries are carried back and, in turn, are smuggled into those markets. The smuggling began as a side line in connection with the illicit traffic in alcoholic beverages. It is still being conducted in connection with liquor running, but the side line has become a much more important part of the undertaking. In many instances it is known to be more profitable to import certain concentrated chemicals and special pharmaceuticals than it is to bring in whiskey.

There is some reason to think that dye importations are being made at ports other than New York in the hope that appraisers, less skilled than are those at the port through which most of the dyes come, may value them at lower figures. This matter has been called to the attention of the Customs Division of the Treasury Department and it is expected that orders will be sent to all collectors to see to it that their appraisers are particularly careful in the handling of dye imports.

Trails of high-priced drugs and fine chemicals, and in a few cases highly concentrated dyes, which have been smuggled into the United States are being followed by agents of the special agency section of the Customs Division in an effort to trace the exact points of leakage.

Specific shipments of salvarsan have been traced to the West Indies. They were landed presumably on the South Atlantic coast or the Gulf coast. One shipment of the same drug has been located in Chicago, but whether it was part of a shipment originally landed in the South and then taken North or whether it was slipped across the Canadian border has not been established. Information also has been obtained by the special agency service that several shipments of imitation and worthless salvarsan have been sent into the country and disposed of.

Some drugs and chemicals are being smuggled across the Mexican border and some are being landed along the north Atlantic coast.

The rum runners have blazed the path for a renewal of smuggling operations of a general character on a wide scale, according to customs officials in Washington, and a number of smugglers find it more profitable to handle drugs and chemicals, jewelry and fine laces than to handle whiskey.

While this condition has been noted for the last 3 years, the last year has witnessed its greatest development, the officials say. Because of the general increase in smuggling, the special agency section, which is the customs secret service, has asked for an increase of $3,500,000 in its appropriation for the fiscal year 1925, the increase to be used to augment personnel and to increase salaries, the low basis of which is driving many investigators of long experience out of the service.

Charles A. Kraus Awarded Nichols Medal

The award of the Nichols medal for the current year has just been made to Dr. Charles A. Kraus, at present professor of chemistry and in charge of the laboratories at Clark University. This medal is awarded each year to the author of the best paper published in A.C.S. journals.

Dr. Kraus is well known for his achievements in the field of physical chemistry—notably with regard to the correlation of conductance phenomena. His career of research and of teaching began soon after his graduation from the University of Kansas in 1898 with the degree of Bachelor of Science in Electrical Engineering. From that time until 1912 he worked and studied in several universities, including Johns Hopkins, the University of California and the Massachusetts Institute of Technology. At M.I.T. Dr. Kraus obtained his Doctor's degree in 1908, becoming an assistant professor of physical chemistry there four years later.

Besides his work in conjunction with Prof. W. C. Bray of the University of California which resulted in the well-known equation for the interpretation of conductance phenomena, Kraus has done considerable work on solutions of metals and salts in ammonia which has enabled him to derive certain relations between electrolytic and electronic conductance in such solutions. Continuing his work on conductance, Dr. Kraus has been led to a consideration of the electron as a free radical in metals. Although his interpretation of results obtained is not accepted universally, it is recognized that his contribution in this phase of pure scientific research has been great and that his data on conductance are significant.

Sharp Decline in Chemical Imports Throughout November

Falling Off Larger in Commodities on Free List—Exports Show Gain Over Preceding Month

NOVEMBER saw a very unusual decline in the imports of chemicals and allied products. The decline came largely in commodities on the free list, but there was a falling off in the imports of dutiable chemicals as well. The value of all free-list chemicals imported during November was $4,516,731. This is more than $3,000,000 less than imports during October. Dutiable chemicals imported during November were valued at $2,978,380. The decline in imports of coal-tar chemicals alone accounts for nearly $1,000,000 of the decrease.

The decline in the total did not extend to paints, pigments and varnishes, as a slight increase in those commodities was registered. The value of those imports during November was $258,967.

Imports of fertilizers fell from above the $5,000,000 mark in October, to $2,976,013. The falling off in imports of sodium nitrate was more than one-half. November entries aggregated only 30,456 tons, as compared with 105,954 tons in November of 1922 and 56,788 tons in October, 1923.

Certain items showing a decided change as compared with November of last year are the following:

	Nov. 1922	Nov. 1923
Creosote (gal.)	5,020,445	3,814,248
White arsenic (lb.)	461,411	1,566,775
Oxalic acid (lb.)	460,514	144,262
Sulphuric (lb.)	622,000	1,440,800
Nitrate of ammonia (lb.)	1,540,193	165,608
Cyanide of potash (lb.)	7,590	423,840
Cyanide of soda (lb.)	1,345,007	1,061,367

Exports of chemicals in November, amounting to $9,152,978, showed an increase over the preceding month. There was a decline, however, in the exports of coal-tar products. This total for November was $667,111, which was more than $200,000 less than the movement in October.

Exports of sodas and sodium compounds reached a total of $719,227. While the increase in value is less than $100,000 as compared with the October movement, the volume of business was much greater, the November total climbing to the 30,000,000-lb. mark.

Exports of pigments, paints and varnishes in November amounted to $1,407,595. This compares with $1,249,321 in October and $1,072,055 in November of last year.

Fertilizer exports also showed an increase. Their value in November amounted to $1,240,006. This compares with $1,078,961 in October. There was a decline, however, in the amount of sulphate of ammonia exported. The value of those exports in November was $485,873, whereas in October the aggregate of value was $667,861.

There was a sharp upturn in the explosives group. The November total was $357,451, more than $100,000 greater than the movement in October.

The more decided changes shown by the November figures follow:

	Nov. 1922	Nov. 1923
Ammonia	1,122,125	267,445
Acetate of lime	732,624	1,424,157
Calcium carbide	425,171	915,540
Bleaching powder	3,784,009	1,415,637
Borax	2,034,802	1,485,096
Caustic soda	12,343,838	9,559,114

A.C.S. Elections Announced

Dr. Leo Hendrik Baekeland, internationally known for his invention of Bakelite and honorary professor of chemistry in Columbia University, has been elected president of the American Chemical Society for 1924. Dr. Baekeland, though a native of Ghent, is, according to the statement of the society, "inseparably identified with the most fruitful era in the advance of chemical science in this country."

Dean H. P. Talbot of Massachusetts Institute of Technology and George D. Rosengarten of Philadelphia have been re-elected directors of the society, which has named the following councilors at large:

Dr. C. A. Browne, chief of the U. S. Bureau of Chemistry, Washington; Prof. H. N. Holmes of Oberlin College, chairman of the committee on colloid chemistry of the National Research Council, Prof. L. W. Jones, Princeton University, and H. S. Miner, industrial chemist, of Gloucester, N. J.

Canadian Co. to Poison Weevil

Ceramic Chemical Metals, Ltd., a new company in the Canadian chemical field, in the spring will begin production of a product designed to eliminate the cotton boll weevil. The nature of this compound has not been made public.

Site for the new plant has been purchased in the so-called Crowland industrial section near Bridgeburg, Ont., and construction will start immediately after the first of the year. At the beginning of production it is estimated that fifty men will be employed. The plant will cost about $75,000. J. F. Hickling, formerly of Metals Chemical, Ltd., of Welland, Ont., will be the general manager.

Chemical Salesmen Hold Annual Christmas-New Year's Party

The annual Christmas-New Year's party of the Salesmen's Association of the American Chemical Industry was held at the Builders Exchange, New York City, Thursday evening, Dec. 27. About 70 members were present. The work of the entertainment committee was highly praised and the committee was extended a rising vote of thanks. Among the entertainment features were a cabaret show and a Santa Claus who distributed gifts to the members.

Germans Active in Dye Plants in Italy

Further evidence has reached this country that German dye interests have gained a very secure foothold in Italy. While there is no reason to think that the Germans have acquired financial control of more than one of the large Italian concerns, Germans are much in evidence at all the Italian dye plants. In most cases, it is believed that this simply means that the Italian owners are making use of German skill which cannot find employment at home. There is reason to believe, however, that in certain instances German influence is shaping the policy of other plants.

Large Japanese Menthol Crop

The final estimate of the Japanese menthol crop is for 500,000 kin (1 kin = 1.3228 lb.) of Hokkaido and 150,000 kin of Sambi, or a total of 650,000 kin, compared with the first estimate of 600,000 kin, Hokkaido, and 200,000 kin, Sambi, or a total of 800,000. The difference between the two estimates is due to the dry weather prevailing during the early part of the year and to the excessive rainfall of the last six weeks. There is practically no stock of menthol in the hands of producers at the present time.

The new crop begins to appear on the market in November. Annual consumption and exportation is estimated at 500,000 kin and this year's crop of 650,000 kin indicates a surplus of 150,000 kin.

Larger Castor Seed Production in Manchuria

The old custom of Chinese farmers of planting castor plants on the borders of their fields to prevent insects of all kinds from harming their gardens has resulted in a source of wealth for the Chinese people. In autumn the lignin of this plant gives abundant fuel, while the seeds contain up to 63 per cent of oil, and after the oil is extracted the residue is used as fuel and fertilizer. According to Consul G. C. Hanson, Harbin, China, during the past autumn castor seeds sold in the Changchun region at 80 to 90 Mex. cents per pood (36 lb.), and unadulterated pure technical castor oil demanded a price of $4 Mex. Harbin chemical engineers have produced a special railway car lubricant, which they call Ricinol and which has been pronounced an economical and efficient car lubricant. During 1922 Manchuria exported approximately 500,000 poods of castor seeds, increasing the price to $1.60 Mex. per pood. There is 5,000 poods available in Harbin at the present time. Increased demand has caused a larger acreage to be planted this year.

Washington News

May Use Generators With Arsenic in Saving Cotton

Much in the same way that charged sand dispels fog, particles of calcium arsenate have been found to acquire a positive charge of electricity when the dusting of cotton plants is done by means of an airplane. The positively charged particles are attracted by the negatively charged plant with the result that a great increase in efficiency has resulted in dusting operations in connection with boll weevil control.

These observations were made during experiments conducted by the Bureau of Entomology. The experiments were begun simply with the idea that an airplane had fewer physical disadvantages to overcome than did the machines which applied the poison from the ground. The ground machines must be operated during the short period in the early morning when the dew on the plant causes the powdered calcium arsenate to stick. The particles discharged from airplanes, electrically charged through their friction with the air, stick to the plant regardless of the presence of moisture.

This discovery has led to experiments on the part of the government's scientists with generators mounted on the ground machines looking to the similar electrification of the particles of the poison which are discharged by these devices. It is stated officially that this experiment appears to be successful. Since the annual depredations of the boll weevil result in losses running into millions of dollars, the adoption of devices to electrify calcium arsenate could well run into large proportions. It also marks another avenue toward the use of electricity in farming operations.

Market for Chemicals in Brazil

Consul John R. Bradley in a report from Porto Alegre says there is a small but constant and growing market for industrial chemicals in the Rio Grande do Sul, Brazil, consular district. This district is composed of the States of Santa Catharina and Rio Grande do Sul, but it is the latter state that offers the greater opportunities for the sale of these commodities. The demand is met largely from England and Germany, both of these countries being well represented.

Manufacturing is developed to a surprising degree in the Rio Grande do Sul district, and several factories recently have been extended. The industry is protected by high tariffs. The factories include paper mills, manufacturing wrapping paper and cardboard in general; two glass factories, making bottles, lamp chimneys, dishes, vases, etc; one fertilizer factory, which turns out about 2,000 tons a year, but imports very little material, and does not use sulphuric acid to any great extent; numerous soap and perfume factories; tanneries and carbonated water works; two or three concerns making insecticides and fungicides; and five or six textile factories, some of them employing several hundred men.

Report on License Applications Under English Dyestuffs Act

A report from London states that the Dyestuffs Advisory Licensing Committee in referring to the dyestuffs act of 1920 gave the following information regarding applications for licenses during November: The total number of applications received during the month was 612, of which 485 were from merchants or importers. To these should be added eight cases outstanding on Nov. 1, making a total for the month of 620. These were dealt with as follows: Granted—433 (of which 413 were dealt with within 7 days of receipt). Referred to British makers of similar products—119 (of which 105 were dealt with within 7 days of receipt). Referred to reparation supplies available —40 (all dealt with within 2 days of receipt). Outstanding on Nov. 30, 1923 —28. Of the total of 620 applications received, 558, or 90 per cent, were dealt with within 7 days of receipt.

Canada Changes Sulphate Tax

A change in the royalty provisions of the alkali mining regulations of Canada has been made as the result of representations by Thomas M. Molloy, Commissioner of Labor and Industries for the Province of Saskatchewan. Under the new regulations the maximum value of the unrefined product at the point of shipment has been fixed at \$2 per ton. The royalty, being on the basis of 12½ per cent of the selling value of the salts, cannot now exceed 25c. per ton. Under the old regulations the royalties were based upon the selling value of the salts or brine in their natural state, which fluctuated with the market, placing the producer in the position of being unable to determine his royalties in advance.

The six deposits in Saskatchewan proved up by the Dominion Government show an approximate quantity of between 17,000,000 and 20,000.000 tons of sodium sulphate. Some of the biggest deposits have not yet been touched.

Germans Offer Glauber Salts in Swedish Market

In a review of the Swedish chemical market *Traevarutidning* says that certain British manufacturers of glauber salts are now quoting 90 to 95s f.o.b. for first open water shipment. Meanwhile new German offers continue to appear. These relate only to small parcels of a few hundred tons, but the paper advises the postponement of further purchases until it is seen whether there is anything in the possibilities suggested by German manufacturers. The paper believes that German offers of 75 to 80 kronen c.i.f. Swedish port would be acceptable. The tendency of the market is very uncertain.

German Reparation Dyes Reach United States From Italy

There is an increasing belief in this country that reparation dyes form a part of the imports reaching the United States from Italy. It is known that the Italian industry is quite hostile to the domestic distribution of those dyes. This attitude on their part probably increases the possibility of exporting these dyes in defiance of the regulations against it. There is no thought that the Union of Producers and Consumers is not acting in entirely good faith in the distribution of reparation dyes. The mishandling doubtless comes after a series of resales.

Shortage of Industrial Alcohol in Cuba

In a report on the alcohol industry of Cuba Frank E. Coombs, Trade Commissioner at Havana, says that scarcity of exhausted molasses there has been growing more and more serious since the early summer, and with it the shortage of alcohol for industrial purposes, which in Cuba means the two principal employments as motor spirit and as stove fuel. Of the more important distilleries, thirteen are practically shut down.

The Agrupacion Nacional de Destiladores has called upon the Cuban Government, through Secretary of Agriculture Betancourt, for immediate relief through measures designed to restrict exportation from Cuba of residual molasses in such a manner as to assure a sufficient supply for the distilling industry remaining in the country from year to year. Owing to the great local advance in the price of denatured alcohol for various purposes, it is quite possible that there will result a stimulation of the plans of the sugar companies for taking into their own hands the production of alcohol from their own molasses.

Wool Laboratory Staff Announced

The following committee has been selected to control and direct the laboratory recently established in Toronto by the Canadian Woolen Manufacturers' Association for the purpose of dealing with the many problems confronting this rapidly growing industry: Chairman, D. C. Dick, of the Cobourg Dyeing Co., Cobourg, Ont.; Dr. F. Zeidler, Dickinson Dye Works, Toronto; A. Burton, Middlesex Mills, Ltd., London, Ont.; H. Battye, Barrymore Cloth Co., Toronto, and P. F. Fitch, Textile Processing Co., Toronto. Special attention will be given at first to problems in dyestuffs and chemicals.

New Jersey Ceramists Discuss Their Industry From Many Angles

Well-Arranged Program of New Jersey Clay Workers' Association Covers Clay Deposits, Refractories, Feldspars and Flint

MORE than 100 members and guests assembled for the annual meeting of the New Jersey Clay Workers' Association and Eastern Section of the American Ceramic Society at the new ceramics building, Rutgers College, New Brunswick, Dec. 19, and both morning and afternoon sessions brought out spirited interest in technical and current topics under discussion.

Following a brief business session and short presidential address by Andrew Foltz, head of the Lambertville Pottery Co., Lambertville, N. J., the morning was given over to a talk by Dr. M. W. Twitchell, Assistant State Geologist, Trenton, which proved to be one of the features of the gathering. The address was illustrated with a number of interesting lantern slides.

Geology of Clay Deposits

While Dr. Twitchell's subject was stated as "The Geology of the Clay Deposits of New Jersey," it had much to do with the general fundamentals of how nature makes clays and the natural process of evolution until the material is taken from the ground. Speaking of the clays of New Jersey, Dr. Twitchell said:

"In the neighborhood of the Hackensack River and along this stream west of the Palisades and from the region of the town of Hackensack to Little Ferry remarkable glacial clay exists which has been exploited for many years for the manufacture of brick. It is an aqueous, glacial clay, brought about from the combined action of the glacier in creating the material from the rock and making a rock floor, and the action of the streams on the edge of the ice, carrying the material fed to it by the glacier and depositing it as a stratified deposit.

"In the district around the mouth of the Raritan River, within a radius of 10 miles from the center of Perth Amboy, the sedimentary clays were deposited in the cretaceous period and were among the early beds formed in the coastal plain in the evolution of the state. This section dominates all other clay-producing districts of the state. The thickest member of the Raritan clay group is found on the south side of the Raritan River, near South River, where the material is so thick as to make practical the use of a steam shovel in mining.

"The distinct Raritan product, known as Raritan fireclay, in a restricted sense is mined along the Raritan River itself, and the beds of the clay actually rest on the old decayed surface of the red sandstone and the red shale. The whole group of Raritan cretaceous clays extends across the state to Trenton and on the southern side of the Delaware River to Salem County. It is not so well divided here, and it is not possible to subdivide into the same number of individual members as in the district around the mouth of the Raritan River, due primarily to the fact that not enough openings have been made to allow for necessary study."

Election of Officers

Before adjourning for luncheon, the following officers were elected for the ensuing year: Charles W. Crane, the Crossman Co., South Amboy, president; Leslie Brown, chief chemist, Lenox, Inc., Trenton, vice-president; Charles A. Bloomfield, Bloomfield Clay Co., Metuchen, re-elected councilor; and Prof. George H. Brown, director, department of ceramics, Rutgers College, re-elected secretary and treasurer.

The afternoon session was opened with an interesting address by H. C. Mueller, head of the Mueller Mosaic Co., Trenton, on the subject of "Versatility." The speaker made a plea for more extended and practical instruction of students in ceramic schools, and cited the ancient potter and his method of operation as an example of extreme versatility in the production of wares.

Feldspar

Prof. J. B. Shaw, Alfred University, Alfred, N. Y., gave an illuminating talk on the subject of "Feldspar," being in the line of a plain, everyday discussion of the material, its varying character of composition, and use in the clay mix.

In opening, he stated that feldspar from the viewpoint of the chemist is a mineral which, upon analysis, contains silicate and alumina, and some basic material, usually potash and soda, with a small amount of lime or magnesia. From the standpoint of the mineralogist, the material likewise is a mineral, to be divided and subdivided into a number of classes. There are three principal feldspars in which the ceramist is interested, these being the potash feldspar, the soda feldspar and the lime feldspar. Each of these acts in a very radical manner when placed in a ceramic body.

It is practically impossible to secure in commercial channels a pure potash feldspar. There are deposits which run comparatively high in potassium oxide, all of them containing some soda; there are deposits of so-called soda feldspar, which are decidedly variable in their content of potassium and sodium oxide, and these two, in turn, are always contaminated to a certain extent with lime feldspar.

Feldspar is the principal ingredient in the white ware body to promote vitrification, to produce toughness and durability in the finished material. If this is the case, as all practical men know, the variation in the composition of these feldspars does produce very radical differences in the quality of the ware manufactured under the same heat treatment.

A potash-feldspar with a small percentage of soda is more fusible and more fluid at a given temperature than the same feldspar with a smaller percentage of soda in it. The variation in the alkali content of the feldspar is an important factor, consequently, in determining the fusibility, the fluidity and accordingly the tendency of the ware to warp at a given temperature. But there is another factor which in a feldspar deposit varies more widely than the alkali content, and this is the silica content.

When the chemist analyzes feldspar, he stipulates silica. This silica is there in two forms, or the uncombined free quartz and a combined silica in the feldspar. It is the proportion of the first noted that produces the wide variation in the composition of the feldspar; it is one of the very important factors in determining the properties of that feldspar, and likewise the properties which it will impart to the finished product.

Take a body consisting of, say, 50 parts clay, 30 parts spar and 20 parts quartz. If the batch is weighed out with feldspar containing no free quartz, the body composition will conform to the desired formula. But if the next load of feldspar received at the plant should contain 20 per cent of quartz, as is not an unusual occurrence, the composition of the body will be: 50 parts clay, 24 parts feldspar and 26 parts quartz. The question of the control of the composition of these feldspars is one that has not been very thoroughly investigated, and one that most certainly deserves serious study on the part of both the producer and the consumer. Our best deposits of feldspar in the past have been worked out and have disappeared, and we shall come to a time when inferior deposits, heretofore left standing, will be worked over. It will, therefore, be the job of the ceramic engineer to determine how these different grades of feldspar can be utilized in the production of ware even including lime feldspar, which ordinarily now a potter would not think of using.

In concluding, Professor Shaw said that he had developed a process whereby the quartz content of feldspar can be determined within 3 per cent. This covers, primarily, the blending of the spar at the dike in such a way as to guarantee a uniform content of quartz, car after car, to within the percentage noted.

Industrial Applications of Refractories

In opening his address, the next speaker, M. C. Booze, senior fellow, Refractories Manufacturers' Association, Mellon Institute, Pittsburgh, Pa., brought out the subject of his talk, "Some Aspects of the Application of Refractories to Industrial Installations," in a comprehensive way. He said that the popular conception of a refractory material is one to resist heat; while in a general sense it is true

that the ultimate failures of refractories are due to heat, in the majority of cases the heat merely accelerates some physical or chemical action which tends either to destroy the refractory or make it incapable of further service. It is only in isolated cases that failure occurs, because of a temperature sufficiently high to cause complete fusion or melting.

There are five major causes for the failures of refractories, these being heat, spalling, slagging, abrasion and load. In all furnaces at least three of these agencies exist, and all of them may be active to some degree. So far as is known now, it is impossible to produce a refractory that will resist all successfully.

The purchaser, it was set forth, has a choice of materials which includes fireclay, silica, alumina, magnesite, chrome, silicon carbide and others of less general use. The magnesite and chrome refractories, while almost indispensable to the steel industry, do not find wide application otherwise owing to their tendency to spall. Also, their relative cost is high.

Silica refractories are being employed in increasing amounts in furnaces where temperatures are high, and are noted generally for retaining their strength nearly to the point of fusion. Moreover, they show no shrinkage. Such refractories, however, are very sensitive to temperature changes between room temperature and 600 deg. C., and for this reason do not generally give satisfactory service in other than continuously operated furnaces.

By far the greatest percentage of fireclay brick manufactured are those the compositions of which lie between the two extremes of high silica and high alumina. Taken as a class, the alumina content will vary from 20 to to 40 per cent, and silica in inverse proportion. Those with low alumina content are considered an inferior product, as they usually show low refractoriness and considerable deformation under load.

In the production of refractories for industrial application, the manufacturer may utilize several means for adapting them to the desired purpose in addition to the choice of raw materials. The fineness of grind, method of production and degree of burning have considerable influence upon the physical properties of the resulting product.

The maximum resistance to spalling is obtained by a coarse grind, soft burn and an "open" body. The maximum load-carrying capacity is produced in a dense, hard-burned brick. High density is secured by manufacturing from a stiff mud and using a fine grind. High resistance to slag action and abrasion is derived in the same way, and were it not for spalling, the possibility of producing a universal brick would be considerably greater. The effect of heat alone, it was stated, may be controlled to some extent by the process of the manufacture.

New Jersey Clay Workers' Association and Eastern Section, American Ceramic Society

Flints and Thermal Expansion

The final paper of the session was by W. L. Shearer, department of ceramics, Rutgers College, on "The Effect of Flints on the Thermal Expansion of Pottery Bodies," covering a series of tests made with the assistance of the Bureau of Standards.

The experiments were on dunting and quenching. For the first noted, the pieces made were placed on a sheet iron plate, about 18x18 in., and heated in the laboratory enameling furnace. It was possible to heat the pieces, or cups, very uniformly by soaking them for approximately half an hour at the desired temperature, this being 625 deg. C. They were then quickly withdrawn and permitted to cool in the air of the room.

The conclusions showed the following: (1) That failure characteristically occurs at the point where quartz inverts to the beta form, or 575 deg. C. (2) All ordinary white ware bodies will dunt if they be suddenly withdrawn from a region at a temperature above 600 deg. C. and allowed to cool in air at a temperature of about 30 deg. C. If failure does not occur on the first cooling, it will develop after a small number of successive coolings. (3) The rapidity of cooling, and also probably heating, through the critical temperature range, 525 to 625 deg. C., determines whether or not dunting will occur. (4) The tendency to failure by dunting seems to be independent of the porosity of the body.

In the experiments on quenching, disks were heated in a wire basket to a uniform temperature of 200 deg. C. and then plunged into water at room temperature, or 25 deg. C. Each disk was separated from the other for essential air space. They did not split apart, except in rare instances, the fracture being simply a rough, ordinary crack, distinctly different from a dunt.

Semi-porcelain bodies were found to be far more resistant to failure in quenching tests than sanitary or vitreous china bodies; the use of a very finely ground flint in a semi-porcelain body causes failure to occur far more rapidly on quenching.

Certain-teed Products Corporation to Make Felt Base Rugs

A license agreement has been entered into between the Certain-teed Products Corporation and the Congoleum Co., according to which the former is authorized to manufacture and sell felt base rugs similar to those made by the Congoleum Co.

In turning out the new product the trademark "Certain-teed" will be used. When Certain-teed took over Thomas Potter Sons & Co. of Philadelphia in 1920, it acquired facilities for the manufacture of this product in ordinary roll form, and its line will be extended by the arrangement made with the Congoleum Co., which will be put into actual operation in the early part of the year.

News in Brief

Certification by the Bureau of Standards for manufactured articles or products is provided in a bill recently introduced in the U. S. Senate by Mr. Fletcher. The proposal would make possible an official government stamp of approval and make it an offense to misuse such a certificate.

Brick, tile and paving blocks are to be manufactured in Quebec by Citadel Brick, Ltd., recently incorporated for $1,400,000. Acid-proof brick and similar materials are included in the proposed list of products. George Parent and Paul Taschereau are mentioned as owners.

Cleveland steel treaters are to have an opportunity during the coming winter to obtain a first-class course in the principles of the art of heat-treatment. This course is to be given at the Case School of Applied Science, under the auspices of the Cleveland Chapter, A.S.S.T., and consists of twenty lectures to be given by experts in various phases of the subject.

Rubber products are to be turned out again at the Port Dalhousie plant of the Canadian Consolidated Rubber Co. Permanent operation beginning Jan. 1, 1924, is now planned after a 3-year period of idleness.

Shellac products have recently come under the stern eye of the Federal Trade Commission. The De Golyer Varnish Works, Troy, N. Y., has been notified that the practice of labeling shellac products as "white" or "yellow" without indicating that they contain gum substitutes constitutes an unfair trade practice.

Bordeaux mixture combined with 1 per cent of oil makes an excellent spray for citrus trees. Such a mixture combats both insects and fungi with the same application. The U. S. Department of Agriculture has recently published a bulletin giving the results of experiments which developed the combination spray recommended.

The Paper Industries Exposition is to be held this year during the week of April 7. Applications for space up to date indicate that most of last year's exhibitors are planning to be present, with several new ones. Special days are being arranged along with appropriate meetings of interested organizations including T.A.P.P.I.

Fire destroyed the plant of the Horton Steel Works at Bridgeburg, Ont., on Dec. 23, with a loss, mainly of machinery, amounting to about $75,000. The plant, employing 150 men on two shifts, was built in 1917 for the purpose of manufacturing steel tanks.

Material handling and welding with gas or electricity are to be featured on the program arranged for the joint meeting of the Engineering Section of the National Safety Council and the American Society of Safety Engineers to be held at New York on Jan. 22. A round table discussion with eight papers, followed by a banquet, constitutes the day's program.

The Brompton Pulp & Paper Co. has purchased the B. C. Howard timber limits at English Lake in the county of Montmagny, Quebec, for a price in the neighborhood of $1,000,000. The transaction represents one of the biggest deals ever put through in the eastern townships. The property consists of 25,000 acres of freehold timber land in Canada and controlling interest in 140,000 acres of freehold in the state of Maine. The purchase of this property will assure the Brompton company of from four to five million cords of pulp wood.

Larger Production of Acetate of Lime and Methanol in October

The Department of Commerce announces the October production of acetate of lime and methanol based on reports received from manufacturers. The following table gives for October the output of wood chemical plants, with comparisons for previous months:

	Acetate of Lime, Lb.	Methanol, Gal.
January	15,478,065	888,608
February	13,194,735	726,037
March	14,732,054	786,774
April	13,237,584	710,987
May	14,667,584	796,481
June	14,129,529	727,458
July	12,873,572	645,673
August	12,815,237	649,063
September	11,541,468	568,091
October	12,822,384	662,708

Michael J. Owens Dead

Michael J. Owens, vice-president of the Owens Bottle Co. and of the Libbey-Owens Sheet Glass Co., died from a sudden heart attack in his office in Toledo, Dec. 27. His life was spent in the glass industry and as a result of applying his mechanical genius to the problem of eliminating hand labor, several branches of the industry were completely revolutionized during his lifetime. Through the development of the Owens bottle machine, it became possible to blow bottles mechanically at greater speed and lower cost than was feasible under the hand system. Mr. Owens was also instrumental in developing the Colburn sheet-drawing process into a commercial success.

Michigan Alkali Co. Takes Over Sales End of Its Products

The Michigan Alkali Co. has sent an announcement to the trade to the effect that after Dec. 31 all sales and contracts will be handled through its own organization's general sales department at 21 East 40th St., New York. E. M. Taylor will act as director of sales for the company. This arrangement terminates the agreement of many years during which Edward Hill's Son & Co. acted as selling agents for the products of the Michigan Alkali Co. Edward Hill's Son & Co. will continue their business in arsenic and other lines at their present address but later on will have new quarters.

Financial

The National Fireproofing Co. has declared an extra dividend of 1 per cent, payable Jan. 10, to stock of record Dec. 28.

A regular quarterly dividend has been declared by the United States Industrial Alcohol Co. The dividend is on the preferred stock and amounts to $1\frac{3}{4}$ per cent.

The New Jersey Zinc Co. has declared a regular quarterly dividend of 2 per cent, payable Feb. 9 to stock of record Jan. 31.

The Commercial Solvents Corporation has resumed dividends on Class A stock by declaring a quarterly dividend of $1 a share. A dividend of $2 a share on first preferred stock also was declared.

The New York Stock Exchange has approved the application of the American Metal Co., Ltd., to list on the Exchange 70,000 shares of common stock of the company.

The United States Worsted Co. directors have voted to omit the quarterly dividend of $1.50 per share on the preferred stock, which has been paid in 6 per cent scrip during the past two quarters. The company showed manufacturing profits of $1,060,000 in 1922, and a net profit after all charges deducted of $25,000.

The U. S. Finishing Co. has declared a dividend of 2 per cent on the common and regular quarterly dividend of $1\frac{3}{4}$ per cent on the preferred. Quarterly dividends of $1\frac{3}{4}$ per cent were paid in 1923 and an extra of 1 per cent, bringing total paid this year to 8 per cent.

Boston advices state that stockholders of Harmony Mills, at special meeting, ratified a 200 per cent stock dividend on the common stock, and declared a regular quarterly dividend of $1\frac{3}{4}$ per cent on the preferred.

The Merrimac Chemical Co. report for the year ended Sept. 30, 1923, shows net working capital of $2,696,581, compared with $2,110,027 a year ago, a gain of $586,000. Inventories stood at $1,090,679, against $806,180. The property account was reduced during the year by $317,000.

Change in Firm of Charles Hardy & Ruperti

Charles Hardy & Ruperti of New York have announced that J. R. Ruperti has retired from the company. With the withdrawal of Mr. Ruperti the name of the firm will be changed to Charles Hardy, Inc., under which title the business was carried on prior to the entrance of Mr. Ruperti into the company. A general business in chemicals, minerals and metals will be continued, but after Jan. 1 the offices of the company will be located in the Pershing Square Building, 100 East 42nd St.

Heavy Expansion in Glass Industry Due, According to Plans Indicated

Coming Period of 12 Months Will Mark Investment of Eighteen Million—Development Not Confined to Any Locality

THE year 1924 is destined, it seems, to be a notable one with regard to expansion in the glass industry in the United States and projects now announced for completion during the next 12 months aggregate more than $18,000,000 in estimated investment. Foremost among the new plants are those of the National Plate Glass Co., Detroit, Mich., a subsidiary of the Fisher Body Corporation, which, in turn, is a division of the General Motors Corporation. Work is now in progress on the first unit of a new plant at Ottawa, Ill., consisting of a number of buildings to be devoted to the manufacture of sheet glass; later extensions to this works will bring the cost to approximately $9,000,000. The same company is also commencing work on a new plant at Blairsville, Pa., comprising the rebuilding and remodeling of the former works of the Columbia Plate Glass Co., at this location, acquired by the National company in 1920, at the time of its formation. A number of new units will also be constructed at this plant for considerable increased output, with total estimated cost of buildings and machinery placed at $5,000,000. As in the case of the Ottawa works, production will be concentrated upon plate glass, about one-half of the output being used by the parent company for closed automobile body use, and the remainder being sold commercially, primarily to the mirror and fixture trades.

The Libbey-Owens Sheet Glass Co., Nicholas Building, Toledo, Ohio, will proceed with the erection of the first unit of a new plant on site near the city, and will defer only other plant units, as recently announced. The structure will be 1-story, 100x187 ft., and will be equipped largely as a polishing works for plate glass. Other smaller buildings will also be built, with total cost estimated at $500,000. Later extensions will bring this to more than $1,000,000. The DeVore Co., Nicholas Bldg., is architect and engineer. E. D. Libbey is president of the company.

The Clarksburg Glass Co., Clarksburg, W. Va., manufacturer of sheet glass products, will remodel and improve its plant, changing from hand to machine operation. Eight sheet glass machines will be installed and auxiliary equipment. It is expected to increase the output considerably, giving employment to about 250 persons.

The Wheeling Glass Manufacturing Co., Wheeling, W. Va., has taken over the works of the North Wheeling Glass Co., which has been idle for nearly 2 years. Extensions and improvements will be made, and operations resumed at an early date. It is expected to give employment to about 500 operatives.

The Westmoreland Specialty Glass Co., Jeannette, Pa., has completed the construction of a new furnace, in course of building for a number of months past, and will place the unit in service at once, practically doubling the capacity of the plant.

The Weston Glass Co., Weston, W. Va., has closed its plant, effective Dec. 22, until about Feb. 1, during which time extensive alterations and improvements will be made, including machinery repairs. The plant specializes in the production of fancy glassware and has been in continuous service for about 36 months past.

The Sneath Glass Co., Hartford City, Ind., is making improvements and repairs at its plant, keeping one tank in service until the work has been completed. It is proposed to resume operations at full capacity at the earliest possible date.

Canada's Newsprint Production Is Rising Rapidly

The forecast made a couple of years ago that Canada's production of newsprint would sooner or later overhaul that of the United States is very near fulfillment. In November the American total exceeded the Canadian by 8,881 tons, which compares with 7,198 in October. The average monthly difference between the two countries for 11 months to the end of November was 18,616 tons, so that it is apparent as the year draws to a close the difference is drawing down to small proportions.

In November the total production of the two countries was: U. S., 119,720 tons; Canada, 110,839 tons. October, 1923, U. S., 122,073 tons; Canada, 114,875 tons. November, 1922, U. S., 127,983 tons; Canada, 97,148 tons.

Canada's production for 11 months of 1923 has exceeded last year's figures by 172,237 tons, or more than 17 per cent. With the December figures yet to be added, the total production for the year will be in the neighborhood of 1,270,000 tons, compared with 1,081,000 tons in 1922.

Italian Army Studies War Gases

Research in war gases has been begun by the Italian army. At the Arms Conference in Washington the Italians were particularly active in urging the abolition of all use of gas as a legitimate weapon. This attitude was thought to be based on the fact that Italy would be at a great disadvantage, through lack of raw materials, were increased use to be made of chemical weapons.

Until very recently, the Italian military establishment, so far as is known, has done no work of a chemical warfare nature.

Trade Notes

F. H. Timberlake has joined the New York sales force of Ellis Jackson & Co., importers of chemicals and vegetable oils.

Oscar S. Flash, secretary of the Edward Flash Co., has recovered from a severe illness and will resume work this week.

John Donnelly, assistant appraiser at the port of New York, has returned to his duties, having fully recovered from his recent illness.

Reports in the local trade last week were to the effect that the plant of the American Cotton Oil Co. at Guttenberg, N. J., had been sold to Lever Bros., who would make use of it in the manufacture of soap.

John F. Parry, for several years in charge of the vegetable oil department of Franklin Baker Co., has resigned to take effect Jan. 1 and after that date will conduct a brokerage business in oils with offices in the Produce Exchange Building, New York City.

A cable of Dec. 17 from John A. Fowler, Trade Commissioner, Manila, Philippine Islands, states that the copra market is strong, with prices rising steadily throughout November. The closing prices for Correntes was 10.75 pesos per picul. The Manila receipts for November approximated 200,000 piculs.

Property of the Perfection Tire & Rubber Co., Fort Madison, Iowa, including plant and equipment, will be offered for sale at a public auction Jan. 28 by P. S. Junkin, receiver. The factory represents an investment of close to $5,000,000, and was closed about a year ago when the company was forced into bankruptcy.

The Warner Sugar Corporation, New York, has been organized by officials of the Warner Sugar Refining Co., 79 Wall St., to take over its plants and business, including the refinery at Edgewater, N. J., and its subsidiary the Warner Sugar Co. of Cuba, with properties in the Province of Oriente. A bond issue of $6,000,000 will be sold, the proceeds to be used to effect the consolidation and for proposed general expansion. Grove E. Warner is vice-president.

Wilson to Discuss Leather

Leather is to be the topic of the Jan. 4 meeting of the New York Section of the A.C.S. At this meeting John Arthur Wilson, chief chemist of A. F. Gallun & Sons Co., Milwaukee, will discuss the "Scientific Development of Leather Manufacture," illustrating his talk with an unusual series of lantern slides.

Prof. A. W. Thomas of Columbia and Prof. Allen Rogers of Pratt Institute, Brooklyn, are to be present with their respective classes of leather technologists.

Market Conditions

Approach of Inventory Season Retards Buying of Chemicals

Consuming Industries Show Seasonal Unwillingness to Take On Stocks—Contracts Receive Scant Attention—Price Fluctuations Narrow

THE closing week of the year seldom records any large volume of trading in chemicals and allied products. In this respect the past week ran true to form as sellers report quiet conditions generally. In the consuming trades there is not much inclination to purchase spot goods until after the period of inventory taking which is common after the turn of the year. Very little inquiry was noted for contracts but this may be accounted for by the fact that contracts in different selections were placed in recent weeks and a good part of the trade are thus covered ahead.

One of the features of the market was found in the large amount of foreign-made chemicals which came into the local port. These importations covered a wide variety of commodities and the volumes were large enough to carry conviction of the importance of foreign chemicals in our markets. Incidentally official figures for imports of chemicals and allied materials in November were less favorable than those for October but this merely tends to reduce the percentage of increase over last year. The export branch of the chemical industry also holds its gain over the totals for last year as the figures for November not only showed a higher valuation for exported chemicals but a relatively higher increase in quantities due to the lower market price.

Market values have fluctuated only in a narrow way and the weighted index number for the week is practically unchanged but the shade of difference is in favor of lower prices and this is a condition which results largely from the quiet trading movement and the consequent placing of any pressure, which may develop on the selling side of the market.

Some dissatisfaction has arisen in the alkali trade because, although open quotations prevail, they have not been observed by all sellers and this is affecting the stability of the market. This refers to sales made by second hands, as producers are not reported to have sold below the openly quoted prices. Prussiate of potash also is reported to be under selling pressure and values are not sustained in all quarters although prussiate of soda was a little firmer than in the preceding week.

There were no new developments in the market for arsenic and calcium arsenate. Demand in each case was light and considerable quantities of the former reached the local market during the week, coming from Continental ports. Latest official reports bear out earlier estimates that imports of arsenic in 1923 would approximate 10,000 tons.

Phenol Advances Under Limited Spot Offerings—Prussiate of Potash Weak—Prussiate of Soda Strengthens—Odd Lots of Permanganate of Potash Sell at Concessions—Arsenic Quiet and Unchanged—Resale Price of Caustic Soda and Soda Ash Irregular—Caustic Potash Firm on Spot.

Acids

Acetic Acid—It is noted that production of important raw materials used in making acetic acid is increasing but this has not affected selling prices. Demand for the acid is fair with all grades meeting with interest. Competition remains keener in the higher grades as imports are largely of the latter because of the advantage given under the tariff. Open quotations for acid are easy with the possibility of shading in some quarters. Quotations are: $3.38@$3.63 per 100 lb. for 28 per cent; $6.78@$7.13 per 100 lb. for 56 per cent; $9.58@$9.83 per 100 lb. for 80 per cent; $12@$12.78 per 100 lb. for glacial.

Citric Acid—The market has been irregular with buying orders limited and some sellers have been willing to do 46c. per lb. Others have quoted 46½c. per lb. and upward so that values depended on seller. The lowest prices were quoted for imported grades as the asking price for domestic makes has been held at 48@49c. per lb.

Nitric Acid — Where buying orders have not been numerous and the market is far from active, values are not depressed. Producers are not forcing matters because the position of raw materials is giving some concern and some reports say that producing costs may advance and affect the market for the acid accordingly. Current quotations are unchanged at $4.50@$4.75 per 100 lb. for 36 deg.; $4.75@$5 per 100 lb. for 38 deg.; and $5.25@$5.50 per 100 lb. for 42 deg.

Oxalic Acid — According to official figures imports of oxalic acid in November were 144,262 lb. as compared with 460,514 lb. in November last year. The decline in arrivals from abroad was attributed to a slowing up in demand and also to the fact that considerable stocks were held in this market. The market has been quiet in the past week with prices holding at 12@12½c. per lb. according to seller and quantity.

Sulphuric Acid — The movement against contracts continues but is not so active as earlier in the season. Some competition is noted from imported material with imports reaching a total of 1,440,800 lb. in November as against 622,000 lb. for the corresponding period last year. Prices remain a little irregular with reports that concessions can be obtained from the open quotations. Asking prices are $9@$10 per ton in tanks for 60 deg. acid.

Potashes

Bichromate of Potash—Quiet conditions continued throughout the week and no trading of importance is expected in the near future. The market, however, is has held steady as far as prices are concerned. Very little stocks are offered by second hands and producers are asking 9½c. per lb. and upward according to quantity.

Caustic Potash—A firmer feeling prevailed in the market for spot goods. This was said to be due to the fact that low priced goods had been absorbed and present holdings were in firm hands. While it is possible that 6½c. per lb. could have been done prominent factors gave the market price as 6⅝c. per lb. and upward. On shipments 6¼c. per lb. was quoted and in spite of recent reports that offerings for shipment were small it was stated that 6¼c. per lb. was a price at which very large lots could be bought.

Carbonate of Potash — Buying was very limited but prices were not influenced doubtless because sellers took the view that price concessions would have no influence in moving stocks. The fact that offerings are rather large gives an easy tone to values. Prices for 80-85 per cent were 5¾@6c. per lb.

On 96-98 per cent the quotation was 6¼@6½c. per lb., and hydrated was available at 6@6½c. per lb.

Permanganate of Potash—Weak holdings of imported permanganate were on the market and caused an irregularity in price which prevented any stable quotation being given as representative of values. Sales of spot goods were reported as low as 14c. per lb. and asking prices ranged from that level up to 15½c. per lb., according to seller. The quotation for domestic makes was held at 17@17½c. per lb., at works.

Prussiate of Potash—There does not appear to be any stable price for red prussiate of potash. Most sellers are open to bids and with competition keen and buyers not interested, it is difficult to say how low the sales price would be on actual business. Reports place the market price anywhere from 43c. to 48c. per lb. Yellow prussiate was very dull and the market was not put to a test. The general quotation for goods on spot is 22c. per lb., although higher prices also are asked. On forward positions 20c. per lb. has been quoted and is fairly representative of the shipment market.

Sodas

Acetate of Soda—Resale lots have been less prominent and the market has come more fully under control of producers. Consumers, however, are not operating and the small amount of business passing fails to create any feeling of firmness. Quotations range from 5c. per lb. upward on a quantity basis, the inside figure being for round lots, f.o.b. works.

Bichromate of Soda—While the outlook for the coming year is regarded as favorable, it is admitted that trading is slow at present. Market prices have been held at relatively low levels because sellers have competed for round lot businss but producing costs are holding up and unless they are lowered the finished product is not expected to decline in values. Consumers of moderate sized amounts have failed to find sellers at the lowest prices named for contracts and the range according to quantity is strictly observed. In fact the inside price has not been quoted by all sellers and a difference is found according to seller. Quotations are 7¼c. to 7½c. per lb. with the inside figure limited as stated and the outside price generally asked.

Caustic Soda — Of interest in this market is the fact that prices for jobbing lots have not been maintained at scheduled levels by certain sellers. Generally an open price graded according to quantity is effective on this material and sales are made in full conformity with the quotations. A few dealers have been cutting the open prices and have unsettled the market to such an extent that a downward revision in prices would not be unexpected. In the New York district, dealers quote $3.76 per 100 lb. for solid caustic in lots of 5 drums or over. While there have been reports of discounts in the market controlled by producers, the latter have not been accused of price cutting and present dissatisfaction is confined to the dealer trade. The contract quotation of producers is $3.10 per 100 lb., in drums, carlots, at works, with spot and prompt at 10c. per 100 above the contract price. On export business $3.10 per 100 lb., f.a.s. is asked. Exports of caustic in November were 9,559,114 lb. as compared with 12,343,838 lb. in November last year.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	164.43
Last week	164.94
Dec., 1922	165.00
Dec., 1921	145.00
Dec., 1920	189.00
Dec., 1919	245.00
Dec., 1918	277.00

There was a moderate decline in crude cottonseed oil at the mills and the week's index number reflects this change by a reduction of 51 points.

Cyanide of Soda—Imports of cyanide of soda in November reached a total of 1,061,367 lb. which compares with 1,345,000 lb. imported in November, 1922. Prices for cyanide vary according to grade and seller. Domestic grades command a premium over the imported and values range from 19c. per lb. to 22c. per lb.

Nitrate of Soda—A firmer feeling has come into the market as a result of the announcement that the surplus stocks of nitrate held by the government would not be thrown on the market. This destroys any hope of competition from that source and makes buyers dependent on the Chilean market. While demand in this country is slow and reports from Europe say that nitrate is not attractive to the fertilizer trade at current values, the position in primary markets is firm and spot goods in domestic markets are reported to be holding an inside price of $2.50 per 100 lb. with higher prices asked for smaller amounts. Imports of nitrate in November were 30,456 tons as compared with 105,954 tons in the preceding month.

Prussiate of Soda—This market has maintained a steady tone and spot offerings have held at 11¼@11½c. per lb. There were sales at the inside figure but offerings were not free at that price. Shipments from abroad were firmer with 11¼c. per lb. the lowest price heard.

Soda Ash—Conditions are quite similar to those reported for caustic soda. That is the dealer trade is feeling the effect of private prices and the majority of dealers who are holding to the scheduled prices are losing business and the prevalence of private terms in transactions means that the smaller consumers are receiving material at different prices which leads to dissatisfaction. It is stated that steps have been taken to remedy this condition but in the meantime trading is disturbed. No change is noted in the position of producers and prices are repeated at $1.25 per 100 lb. in bulk, $1.38 per 100 lb. in bags, and $1.63 per 100 lb. in bbl. These are contract prices, f.o.b. works, for light ash. Dense ash is offered on contract at $1.35 per 100 lb. in bulk, $1.45 per 100 lb. in bags, and $1.69 per 100 lb. in bbl.

Miscellaneous Chemicals

Acetate of Lime—A decided improvement in export trade is revealed by figures of outward shipments during November. In that month exports were 1,424,157 lb. as compared with 336,000 lb. in the preceding month and 732,624 lb. in November last year. Trading in the local market was reported to be quiet but values are holding a steady position with quotations at $4 per 100 lb. Domestic production of acetate of lime in October was 12,822,384 lb. as compared with 11,541,468 lb. in September.

Arsenic—That imports of arsenic are holding up in volume is indicated by the large amounts which reached the local market during the week. Furthermore, official figures for November place imports of arsenic at 1,566,775 lb. This makes total imports for the 11 months ended November, 18,335,527 lb. Trading was slow during the week with spot and shipment quoted at 13¼c.

Bleaching Powder—A steadier tone was noted in this market and call for stocks was heard both from contract holders and from purchases for prompt shipment. Prices are quoted at $1.25 per 100 lb. for prompt shipment and for deliveries over the year. Export buying remains quiet and outward shipments for November were 1,415,637 lb. against 3,784,009 lb. in November, 1922.

Formaldehyde—The market has held at 10½c. per lb. and while demand was light there was no disposition to shade prices and the market seems strong at the quoted level. Resale lots are well absorbed and first hands have been finding a steady outlet.

Copper Sulphate — No improvement was reported by sellers of imported grades and the spot market was practically neglected with offerings available at around 4½c. per lb. The shipment price was given as 4.30 per lb. but was largely nominal. Domestic grades are steady at 4.75@4.85c. per lb.

Alcohol

A firm undertone prevailed in the market for denatured alcohol, recent activity absorbing most of the surplus holdings. Prices closed nominally unchanged, the No. 5 completely holding at 44½c. per gal., carload basis, drums extra. On the No. 1 special 45½c. per gal. was asked. U.S.P. ethyl spirits held at $4.78 per gal., cooperage included and tax paid. Methanol was offered freely and some traders described the market as unsettled. Pure methanol was offered at 90c. per gal., tank car basis. Production of methanol in October was placed at 662,708 gal., against 568,091 gal. in September and 640,266 gal. in October a year ago.

Coal Tar Products

Higher Crude Oil Market Creates Better Feeling in Benzene Trade—Spot Phenol Strong—Aniline Oil Firm

WHILE no changes in prices occurred in the market for benzene, the fact that Pennsylvania crude petroleum has advanced on two different occasions brought out a better feeling in producing circles. Higher crude oil, in the opinion of operators, should steady the market for gasoline and this, in turn, would bring about improvement in the motor fuel division of the benzene trade. Business placed in benzene, all grades, during the past week was along routine lines only, with the price schedule nominally unchanged on the 21c. basis for the 90 per cent material, tank cars, works. Export demand also was quiet.

Phenol on spot was in scanty supply and on smal lots in dealers' hands quotations range from 30c. to 34c. per lb. in drums. On contract, however, producers stood ready to take on business direct with consumers on the old basis. Demand for refined naphthalene has not yet opened up and traders are offering material for shipment at prices announced some time ago. Crude naphthalene was offered freely for shipment from Belgium and Germany.

Aniline oil is now finding more of an outlet as a denaturant and prices are holding firm. Rumors that production will be curtailed are not taken seriously by factors in this commodity. Demand for pyridine has slackened and with offerings increasing prices are irregular. Salicylates are moving into a firmer position, but up to the close no price revisions were named by first hands.

Market Reports in Detail

Aniline Oil—Demand for aniline oil has been good and prices ruled firm in nearly all directions. Business was put through during the week on the carload basis of 16c. per lb., nearby delivery. Aniline oil is being used as a substitute for pyridine as a denaturant for alcohol under formula No. 7. Aniline oil for red was nominal around 40@45c. per lb.

Aniline Salt—Moderate buying interest was noted. The market was steady, prices holding at 22@23c. per lb., according to quantity and delivery.

Benzene—Producers say that they have been able to move surplus stocks in motor fuel channels, but prices obtained have been unsatisfactory. The uplift in the market for Pennsylvania crude oil gave rise to predictions of a firmer market for gasoline. According to operators, benzene prices should respond readily to any advance in the petroleum product. Producers quote 21c. per gal. on 90 per cent benzene, in tanks, f.o.b. point of production. On the pure the market was more or less nominal at 23c. per gal., tank cars, works.

Beta Naphthol—Producers reported a firm market, but maintained prices on the basis of 25@26c. per lb., according to quantity and delivery. The inside figure obtained on carload lots, shipment from works.

Creosote—Foreign markets were firm on recent buying for America. According to official information the importations of creosote oil into the United States in the month of November amounted to 3,814,248 gal., which compares with 5,020,445 gal. in November a year ago. Domestic production is sold up. Manchester quotes creosote oil for shipment from works at 9¼@9½d. per gal., bulk basis.

Cresylic Acid—Some buying was reported on the part of consumers located on the Pacific Coast, but otherwise the situation underwent little if any change. Competition has been exceptionally keen, and this has unsettled the market in nearly all directions. Low-grade material of 80@85 per cent was available at 65c. per gal., immediate delivery. The 95 per cent grade held around 70c., with the 97 per cent at 75@80c. per gal., according to color, etc. On contract these prices could have been shaded.

H-Acid—Offerings continued at 75@80c. per lb., the price varying according to make and quantity. Second hands offered scattered lots for immediate delivery at concessions.

Naphthalene—Business was described as routine only and prices for crude as well as refined closed unchanged. Leading producers held out for 6@6¼c. per lb. on flake, carload lots, immediate and forward delivery. Ball naphthalene was nominal at 6¾@7c. per lb. Chips were offered at 5@5½c. per lb., as to quantity. Crude for shipment from the Continent was available around 2¼@2⅜c. per lb. on good quality material. The English market for crude has advanced slightly on restricted production.

Phenol—Production appears to be well taken care of and all selling pressure has disappeared. The undertone of the market has steadied considerably in the past month and some traders look for a higher market. Spot material in the resale market did sell at higher prices, odd lots changing hands at prices ranging from 30@34c. per lb., in drums. First hands still quote 26c. per lb., in drums, round-lot basis. On contract it was intimated that 25c. could still be done.

Pyridine—The market was unsettled on freer offerings of shipment goods. The recent decline has checked business. Quotations heard covered a wide range. The market settled around $3.75@$4.25 per gal., immediate and nearby delivery, with futures at $3.25@$3.75 per gal.

Salicylates — Moderate improvement was reported in the demand and with the weakness removed from the market for phenol the undertone at the close was quite firm. First hands announced no changes in the selling schedule.

Xylene—Offerings have increased and the market presents an unsettled appearance. Pure xylene closed at 45@50c. per gal., in drums, the inside figure obtaining on round lots. For the commercial grade 34c. was asked, in drums, and 29c. in tanks.

Ohio Potteries Very Busy

Practically every pottery in the East Liverpool, Ohio district is operating at maximum capacity, and for the first time in a number of years there was no suspension of operations during the holidays, when it has been customary to shut down at least a week to give workers a vacation. A number of local plants have orders on their books to insure the present schedule of operations for 3 to 4 months to come.

Latest Quotations on Industrial Stocks

	Last Week	This Week
Air Reduction	67	67¼
Allied Chem. & Dye	69	69½
Allied Chem. & Dye pfd.	109½	110¼
Am. Ag. Chem.	12	13¼
Am. Ag. Chem. pfd.	37½	40⅝
American Cotton Oil c'f's	9½	9⅞
American Cyanamid	*87	*89
Am. Drug Synd.	5⅝	5½
Am. Linseed Co.	17	17¼
Am. Linseed pfd.	33	34½
Am. Smelting & Refining Co.	57¾	57¾
Am. Smelting & Refining pfd.	95⅝	96
Archer-Daniels Mid. Co. w.i.	22	25
Archer-Daniels Mid. Co. pfd.	90	90
Atlas Powder	53	54
Casein Co. of Am.	*66	*66
Certain-Teed Products	*32	*31
Commercial Solvents "A"	41½	*40
Corn Products	152	160½
Corn Products pfd.	*122	119¾
Davison Chem.	74	73¾
Dow Chem. Co.	*47	*47
Du Pont de Nemours	129	130½
Du Pont de Nemours db.	86⅝	86
Freeport-Texas Sulphur	12⅝	12⅝
Grasselli Chem.	*125	*125
Grasselli Chem. pfd.	*105	*105
Hercules Powder	*110	*110
Hercules Powder pfd.	*104	*104
Heyden Chem.	1½	*1¼
Intn'l Ag. Chem. Co.	¾	1
Int'l Ag. Chem. pfd.	5⅝	7¾
Int'l Nickel	13½	13¾
Int'l Nickel pfd.	79⅝	80
Int'l Salt	*89½	*89½
Mathieson Alkali	39⅝	38½
Merck & Co.	*64	*64
National Lead	134⅝	145
National Lead pfd.	111¼	112
New Jersey Zinc	*148	*149
Parke, Davis & Co.	*78	*78
Pennsylvania Salt	86	*86
Procter & Gamble	*137	*138
Sherwin-Williams	30½	30
Sherwin-Williams pfd.	*100	*100
Tenn. Copper & Chem.	9	9½
Texas Gulf Sulphur	61	61
Union Carbide	56	*56½
United Drug	77½	79½
United Dyewood	39	40
U. S. Industrial Alcohol	64½	68¾
U. S. Industrial Alcohol pfd.	*98	*98
Va.-Car. Chem. Co.	8⅝	9½
Va.-Car. Chem. pfd.	29½	30¾

*Nominal. Other quotations based on last sale.

Vegetable Oils and Fats

Cottonseed Unsettled—Linseed Futures Lower—Argentine Flaxseed Down—Extra Tallow Advances

NUMEROUS price changes took place in the market for vegetable oils and fats. Trading was less active and the undertone in the basic oils was a shade easier. Sales of extra tallow at 8c. per lb. attracted attention. Olive oil foots for shipment from the other side came in higher. New crop Argentine flaxseed was offered more freely, bringing out lower prices and an easier feeling in linseed oil for future delivery.

Cottonseed Oil — Scattered business went through in crude oil at 9⅜@9½c. per lb., tank cars, f.o.b. mills, the inside figure obtaining in Texas, a decline of ⅛c. for the week. The option market for prime summer yellow oil on the Produce Exchange was unsettled, liquidation resulting in lower prices for March forward. According to traders high prices are checking business. Export demand was virtually at a standstill. The January option now appears to be well liquidated and operators believe that the deliveries will be small. The South is said to be heavily long of March and May oil, while refiners mostly were short. The open interest in the March option is estimated at 200,000 bbl. Cash trade was inactive and prices named covered a wide range. Spot prime summer yellow in the outside market sold at 11¾@12c. per lb., cooperage included. Lard compound business was fair, with prices unchanged at 13¼@13½c. per lb., carload basis.

Linseed Oil—Interest centered in the Argentine flaxseed situation. The weather has been somewhat better and the movement of the new crop took on larger proportions. Increased offerings weakened the market and late in the week the January option stood at $1.59½ per bu. at Buenos Aires, a new low for the movement. Private estimates on the crop place the exportable surplus at 55,000,000 to 60,000,000 bu., a record quantity. The lower Argentine market brought out an easier feeling in the American Northwest, January seed at Duluth closing around $2.36⅝, against $2.42½ a week ago. The oil trade was quiet all week and prices were little more than nominal. Nearby oil closed at 90@91c. per gal., in bbl., carload lots, with March-April at 87c., and May forward at 82@84c. per gal., according to quantity and seller.

Castor Oil—High prices for beans caused the market to hold firm. Crushers quote 14c. per lb. on the commercial grade, cooperage basis, carload lots.

China Wood Oil—Not much business went through, but prices ruled steady, both in the Orient and here. Spot oil held at 21@21½c. per lb., cooperage basis. On the Pacific coast several cars of nearby oil sold at 19¾c. per lb., tanks.

Coconut Oil—Prices closed about unchanged. Locally 8⅞c. was asked for Ceylon type oil, in sellers' tanks, nearby and future positions. On the coast the market held at 8¼c. asked, January forward delivery, tank car basis. Offerings were fairly liberal, notwithstanding a rather steady market for copra.

Corn Oil—Sales of crude corn oil were reported at 9¾c. per lb., tank cars, Chicago, indicating that prices were a shade easier.

Olive Oil Foots—Cables from Italy were higher, ranging from 9¼@9½c. per lb., for prime green sulphur oil, c.i.f. New York. Spot oil was scarce and firm around 9¾c. per lb. Covering by shorts accounted for the firmer market.

Imports of Vegetable Oils

Substantial gains are reported in importations of palm, china wood, technical olive and soya bean oils during the 10 months ended Oct. 31. Import statistics for the 10 months' period also reveal that 17,199,794 lb. of oil arrived here under the free list, but no mention is made as to what this quantity consists of. Trade authorities believe that it is made up chiefly of sesame oil. The statistics, with a comparison, follow:

	1923	1922
China wood, gal.	10,487,403	9,375,192
Coconut, lb.	146,907,445	181,565,665
Olive, tech. gal.	5,088,419	3,009,286
Palm, lb	110,879,009	42,018,232
Peanut, lb.	7,406,305	2,064,974
Rapeseed, gal.	1,743,804	1,173,642
Linseed, lb.	42,949,502	143,882,455
Soya bean, lb.	41,574,990	16,183,474
Other oils, free, lb.	17,199,794	....
Other oils, dut., lb.	2,112,136	....

Palm Oils—The advance in tallow steadied prices, but resulted in no important business. Lagos settled at 7¾c., with Niger at 6¾c. per lb., immediate delivery. On futures 7.05c. was asked on genuine Niger and 7.80c. on genuine Lagos.

Peanut Oil—Crude oil was available in a limited way at 12c. per lb., tank cars, mills, South.

Soya Bean Oil—Offerings from the Orient were reported at higher prices. Crude oil for shipment settled at 7.55c. per lb., c.i.f. Pacific coast ports, in bond, bulk basis.

Fish Oils—Newfoundland cod oil held at 68@70c. per gal., immediate delivery. Crude menhaden oil was nominally unchanged at 47½c. per gal., tank car basis, North Carolina, with little offering.

Tallow and Greases—Sales involving more than 500,000 lb. of extra tallow went through at 8c. per lb., ex plant, loose, an advance of ⅛c. Ordinary yellow grease sold at 6¼c. and later 6⅛c. represented the market. Oleo stearine closed nominally at 10⅛c. per lb., carload basis, a decline of ¼c. per lb.

Miscellaneous Materials

Antimony—The market was higher in sympathy with the situation in the Orient. Chinese and Japanese settled at 9⅞c. nominal, which compares with 9c. per lb. a week ago. Cookson's "C" grade, 11¼@11½c. Chinese needle antimony, lump, nominal, 6½@7½c. per lb. Standard powdered needle antimony (200 mesh), 7½@8½c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent, 7.50c.

Casein—The market was unsettled on liberal offerings from South America. Receipts during the past week were quite heavy. Prices on spot ranged from 11@13c. per lb., according to quantity and seller. In some quarters it was said that domestic producers stood ready to meet prices named by importers.

Glycerine—The market in the West was barely steady, while the situation here was not much better. Chemically pure glycerine was offered at 16½@17c. per lb., in drums, the price depending upon the seller. Dynamite was offered in the West at 15½c. per lb. Soaplye crude, basis 80 per cent, loose, closed nominally at 10½@10¾c. per lb. Saponification, loose, was unchanged at 12c. per lb., with no sales reported.

Naval Stores—The market was a featureless affair, prices moving within narrow limits. Turpentine closed at 92½c. per gal., in bbl., which compares with 93½c. per gal. a week ago. Rosins held on the basis of $5.70 per bbl. on the lower grades.

Shellac—Arrivals increased and some pressure was reported on spot. Foreign markets showed little change during the week. T.N. settled at 59@60c. per lb. Bleached, bonedry, closed at 72@74c. per lb., as to seller.

Lithopone—Foreign material arrived in quantity and it was possible to pick up imported goods at concessions. Domestic makers announced no further changes in the selling schedule, maintaining prices on the basis of 6½c. per lb. for immediate delivery and 6⅞c. on delivery in two weeks.

White Lead—The market for pig lead held at 7.40c. per lb., New York. No changes occurred in the lead pigments. Corroders reported satisfactory business on the old basis. Buyers are protected against decline. Standard dry white lead, basic carbonate, is quoted by leading producers at 9¼c. per lb., in casks, carload lots. On the basic sulphate the market held at 8¾c. per lb., in casks.

Zinc Oxide—Trading was inactive, notwithstanding the recent cut in prices on American process oxide. Competition is keen and the undertone remains barely steady in some quarters of the trade. American process, lead free, was offered by leading factors at 6¾c. per lb., in bags, carload lots. The leaded grades held at 6⅝@6¾c. per lb., in bags, carload lots. French process, red seal, was unchanged at 9⅞c. per lb., in bags.

Imports at the Port of New York

December 21 to December 27

ACETIC ANHYDRIDE—15 carboys, London, Order.

ACIDS—Citric—300 bbl., Genoa, L'Appula Soc. Anon. **Cresylic**—35 dr. Rotterdam, Caldwell & Co.; 11 dr., Rotterdam, Lunham & Reeve. **Formic**—83 carboys, Hamburg, H. A. Metz & Co. **Oxalic**—25 csk., Hamburg, Order! 16 csk., Rotterdam, Superfos Co. **Tartaric**—400 csk., Palermo, Order; 300 csk., Palermo, Order; 100 csk. and 200 keg, Rotterdam, W. Benkert & Co.; 610 csk., Rotterdam, Order. **Phenol**—23 dr., London, De Matia Chemical Co. **Stearic**—20 cs., Antwerp, M. W. Parsons & Plymouth Lab.; 85 bg., Rotterdam, Lamont, Corliss Co.

ALCOHOL—4 bbl. butyl, Havre, De Matia Chemical Co.; 11 dr. butyl, London, Order.

ANTIMONY REGULUS—150 cs., Hamburg, Order; 150 cs., Hamburg, Order; 350 cs., Hankow, Columbia Bank; 790 cs., Shanghai, Wah Chang Trading Co.; 176 cs., Antwerp, Order.

ANTIMONY, CRUDE—150 cs., Shanghai, Wah Chang Trading Co.

ARSENIC—550 csk. white, Hamburg, Central Union Trust Co.; 196 csk., London, Order; 400 cs., Shanghai, Wah Chang Trading Co.; 69 csk., Antwerp, J. D. Lewis; 45 csk., Antwerp, White Tar Co.; 63 csk., Antwerp, Schulz & Ruckgaber; 42 csk., Antwerp, Order; 202 dr., Antwerp, Chemical National Bank; 48 csk., Antwerp, Schulz & Ruckgaber; 65 dr., Antwerp, National City Bank; 400 cs., 28 csk. and 15 dr., Antwerp, Order; 123 bbl. Tampico, American Smelting & Refining Co.; 90 bbl. Tampico, American Metal Co.; 31 bbl., Bordeaux, Order; 10 kegs, London, Order.

BARUIM NITRATE—60 bbl., Hamburg, Unexcelled Mfg. Co.

BARUIM SUPEROXIDE—78 csk., Hamburg, W. A. Brown & Co.

BARUIM PEROXIDE—23 dr., London, A. Peuchot, Inc.

BARYTES—650 bg., Bremen, New York Trust Co.; 250 bg., Rotterdam, H. Kastor; 400 bg., Bremen, New York Trust Co.

BORATE LIME—509.755 kilos and 1,000 bg. slag, Antofagasta, Pacific Coast Borax Company.

BUTYL ACETATE—12 dr., Rotterdam, Lunham & Reeve.

CASEIN—417 bg., Buenos Aires, West Virginia Pulp & Paper Co.; 4999 bg., Buenos Aires, Kalbfleisch Corp.; 765 bg., Buenos Aires, Brown Bros. & Co.

CALCIUM CHLORATE—1,000 csk., Hamburg, Irving Bank-Col. Trust Co.; 1800 csk., Hamburg, Mechanics & Metals National Bank.

CALCIUM CYANAMID—7409 dr., Hamburg, Guaranty Trust Co.

CHALK—241 bbl., Hamburg, Cooper & Cooper; 300 bbl., Antwerp, Bankers Trust Co.; 100 bg., Antwerp, Brooklyn Trust Co.; 300 bg., Antwerp, L. H. Butcher & Co.; 400 bg., Antwerp, Brown Bros. & Co.; 1100 bg., Antwerp, Order; 1400 bg., Antwerp, Brown Bros. & Co.; 6410 bg., Antwerp Cooper & Cooper, Inc.; 5221 bg., Antwerp, Order; 500 tons, London, Taintor Trading Co.

CHEMICALS—12 cs., Havre, Ciba Co.; 9 dr., Hamburg, Speiden-Whitfield Co.; 5 cs., Hamburg, Schering & Glatz; 20 csk., Hamburg, A. Hurst & Co.; 2 cs., Genoa, Lehn & Fink; 17 csk., Hamburg, W. A. Brown & Co.; 4 dr., Hamburg, Roessler & Hasslacher Chemical Co.; 93 carboys superoxide, Hamburg, Jungmann & Co.; 10 cans, Havre, Wallerstein Laboratories, Inc.; 56 pkg., Hamburg, Franklin Import & Export Co.; 30 csk., Hamburg, Order; 325 csk., Rotterdam, Stanley, Daggett, Inc.; 320 pkg., Rotterdam, Order; 47 cs., Bremen, Pfaltz & Bauer; 300 csk., Rotterdam, Chemical National Bank; 20 csk., Rotterdam, Schulz & Ruckgaber.

CHROME ORE—2,000 tons, Beira, E. J. Lavino & Co.

COAL-TAR DISTILLATE—163 dr., Liverpool, Order.

COLORS—89 csk. aniline, Havre, Sandoz Chemical Works; 10 pkg. do., Havre, American Exchange National Bank; 6 csk. do., Havre, Carbic Color & Chemical Co.; 43 pkg. do., Havre, Ciba Co.; 3 keg. do., Havre, Irving Bank-Col. Trust Co.; 1 bbl., Hamburg, Carbic Color & Chemical Co.; 30 csk. earth, Hamburg, Reichard-Coulston, Inc.; 14 cs., Hamburg, Order; 3 bbl., Antwerp, Irving Bank-Col. Trust Co.; 9 bbl. aniline, Genoa, Ladenburg, Thalmann & Co.; 16 cs., Hamburg, C. Hellmuth, Inc.; 6 cs., Hamburg, Roessler & Hasslacher Chemical Co.; 15 csk. aniline, Hamburg, Franklin Importing & Exporting Co.; 10 bbl. do., Hamburg, Kutroff, Pickhardt & Co.; 2 csk., Bremen, O. Hommel & Co.; 115 bbl. sienna, Leghorn, R. J. Waddell & Co.; 12 bbl. aniline, Antwerp, Irving Bank-Col. Trust Co.; 3 csk. aniline, Rotterdam H. A. Metz & Co.; 2 csk. aniline, Rotterdam, N. Y. Color & Chemical Co.; 29 pkg. aniline, Rotterdam, Order; 44 cs. earth, Bremen, Fezandie & Sperrle.

CUTCH—500 bg., Singapore, Order.

DIVI-DIVI—244 bg., Pampatar, Eggers & Heinlein; 392 bg., Pampatar, Goldsmith & Co.

FUSEL OIL—23 csk., Hamburg, Order.

FULLERS EARTH—250 bg., Bristol, L. A. Salomon & Bros.

GAMBIER—80 bg., Singapore, Order.

GLAUBER SALT—509 csk., Hamburg, E. Suter & Co.; 120 csk., Hamburg, A. Klipstein & Co.; 326 csk., Hamburg, E. Suter & Co.; 92 bbl., Hamburg, Superfos Co.

GLYCERINE—17 dr., Antwerp, Brown Bros. & Co.

GUMS—100 bg. damar, Singapore, L. C. Gillespie Sons; 100 cs. damar, Batavia, Catz American Co.; 500 cs., damar, Batavia, Order; 610 bg. copal, Antwerp, Central Union Trust Co.; 250 bg. damar, Singapore, Chemical National Bank; 51 cs. copal, Singapore, Brown Bros. & Co.; 150 cs. copal, Singapore, Order; 96 bg. damar, Singapore, Order; 200 cs. damar, Batavia, Order; 764 bskt. copal, Macassar, L. C. Gillespie & Son; 434 bskt. do., Macassar, Irving Bank-Col. Trust Co.; 147 bskt. do., Macassar, Kidder, Peabody Acceptance Corp.; 629 bskt. do., Macassar, Innes & Co.; 95 bskt. do., Macassar, A. Klipstein & Co.; 274 bskt. do., Macassar, M. L. Van Norden; 60 bskt. do., Macassar, W. H. Scheel; 197 pkg. do., Macassar, Order; 186 bg. copal, Antwerp, Kidder, Peabody Acceptance Corp.; 601 bg. do., Antwerp, Order.

IRON OXIDE—34 csk., Bristol, Reichard-Coulston, Inc.; 50 bbl. and 375 pkg., Bristol, Order; 45 csk., Liverpool, J. A. McNulty; 32 csk., Liverpool, Reichard-Coulston, Inc.

LOGWOOD EXTRACT—100 bbl., Cape Haitian, Logwood Mfg. Corp.

LOGWOOD—610,000 kilos, Miragoane, W. & A. Leaman; 144,000 kilos and 583 tons, Miragoane, Order.

LITHOPONE—40 csk., Hamburg, Schall Color & Chemical Co.; 4300 csk., Antwerp, Benjamin Moore & Co., 155 csk., Antwerp, A. Klipstein & Co.; 60 csk., Antwerp, A. Murphy & Co.; 210 csk., Antwerp, E. M. & F. Waldo; 80 csk., Antwerp, Order; 20 csk., Rotterdam, P. Uhlich & Co.; 40 csk., Rotterdam, L. H. Butcher & Co.

MAGNESITE — 424 bg., Rotterdam, Speiden, WhitfieldC.; 96 csk., Rotterdam, H. J. Baker & Bros.

MAGNESIUM CHLORIDE—431 bbl. and 2 cs., Hamburg, Order.

MAGNESIUM SILICATE—40 bbl., Hamburg, Order.

NAPHTHALENE — 500 bg., Hamburg, Order; 1377 bg., Antwerp, Order; 310 bg., Bristol, Order; 3201 bg., Antwerp, Order.

OILS—China Wood—248 csk., Hamburg, Oelrichs & Co.; 93 bbl., London, Order; 90 bbl., London, Order. **Coconut**—Quantity in bulk (amount not specified), Manila, Philippine Refining Co.; Quantity in bulk, Manila, Philippine Refining Co.; 76 hhd., Colombo, Order. **Cod**—200 bbl., London, Order. **Cottonseed**—500 bbl., Bristol, Order. **Palm**—155 csk., Hamburg, African & Eastern Trading Co.; 47 csk., Hamburg, Order; 77 csk., Rotterdam, African & Eastern Trading Co.; 67 csk., Rotterdam, J. H. Rayner & Co.; 115 butts, Liverpool, D. Bacon; 30 bbl., Liverpool, Order; 76 csk., Iddo, Grace Bros. & Co.; 83 csk., Iddo, Niger Co.; 339 csk., Liverpool, Niger Co. **Palm Kernel**—152 bbl., Liverpool, African & Eastern Trading Co. **Peanut**—288 bbl., Bordeaux, American Shipping Co. **Rapeseed**—100 bbl., Antwerp, Irving Bank-Col. Trust Co.

OIL SEEDS—Linseed—8316 bg., Buenos Aires, L. Dreyfus & Co.

POTASSIUM SALTS—290 bbl., Hamburg, Superfos Co.; 20 keg prussiate, Hamburg, Schulz & Ruckgaber; 2200 csk. chlorate, Hamburg, Mechanics & Metals National Bank; 75 dr. caustic, Hamburg, Peters, White & Co., 1270 csk. nitrate, Hamburg, Order; 2500 bg. muriate and 25,063 kilos manure salt, Hamburg, Potash Importing Corp. of America; 1750 bg. sulphate and 1700 bg. manure salt, Hamburg, Potash Importing Corp. of America; 94 csk. salts, Hamburg, Horvall Chemical Corp.; 4000 bg. sulphate, Bremen, Potash Importing Corp. of America; 76 csk. carbonate, Hamburg, Brown Bros. & Co.; 56 bbl. carbonate, Hamburg, Superfos Co.; 90 dr. caustic, Hamburg, Superfos Co.; 235 dr. sulphite, Hamburg, C. S. Grant & Co.; 100 bbl. sulphite, Bremen, Potash Importing Corp. of America; 13128 bg. muriate, 1333 bg. kainite and 1500 bg. manure salt, Antwerp, Societe Commercial des Potasses D'Alsace; 60 keg nitrate, Rotterdam, Order.

PYRIDINE—26 dr., London, R. W. Greeff & Co.; 2 dr., London, Federal Sugar Refg. Co.; 4 dr., London, Monsanto Chemical Works; 5 dr., London, Meteor Products Co.; 21 dr., London, Order; 8 dr., Rotterdam, Lunham & Reeve.

QUEBRACHO—3064 bg. extract, Buenos Aires, Bank of N. Y. & Trust Co.

QUICKSILVER—1,000 flask, Genoa, National City Bank; 120 flask, Vera Cruz, Poillon & Poirier.

SAL AMMONIAC—94 csk., Hamburg, Roessler & Hasslacher Chemical Co., 225 csk., Bristol, C. DeField Co.

SODIUM SALT—99 cs. chlorate, Genoa, Order; 720 dr. caustic, Hamburg, A. Klipstein & Co.; 100 csk., hyposulphite, Hamburg, Order; 100 csk. hyposulphite, Hamburg, Order; 75 dr. sulphite, Hamburg, H. Falck & Co.; 1,000 bg. sulphate, Hamburg, H. Falck & Co.; 134 csk. phosphate, Hamburg, Brown Bros. & Co.; 15 csk. prussiate, Rotterdam, Chase National Bank; 500 bg. phosphate, Antwerp, Order; 800 bg. phosphate, Antwerp, Hollingshurst & Co.; 167 csk. phosphate, Antwerp, Roessler & Hasslacher Chem. Co.; 500 bg. do., Antwerp, Order; 15 csk. prussiate, Rotterdam, Order; 20 cs. cyanide, and 20 csk., carbonate, Liverpool, Order; 199 cs. cyanide, Marseilles, Order.

STRONTIUM NITRATE, 83 csk., Hamburg, Meteor Products Co.; 46 csk, Hamburg, Order.

SUMAC—350 bg. ground, Palermo, Order; 1050 bg. ground and 20 bl. leaf, Palermo, Order.

TARTAR—89 csk., Leghorn, Tartar Chemical Works.; 29 pkg., Naples, C. B. Richard & Co.; 29 csk., Naples, Tartar Chemical Works; 74 csk., Naples, Tartar Chemical Works; 46 csk., Naples, Tartar Chemical Works; 959 bg., Rotterdam, C. Pfizer & Co.

VALONEA — 3724 bg., Constantinople, Order.

WAXES—387 cs. ozokerhite, Bremen, J. Dick; 106 bg. bees, Antwerp, Order; 50 cs. bees, Hamburg, American Exchange National Bank; 950 bg. montan, Bremen, Order; 30 bg. bleached bees, Rotterdam, Pond's Extract Co.; 75 cs. do., Rotterdam, Strahl & Pitsch; 35 cs. do., Rotterdam, Order; 30 bg. bees, Rotterdam, Pond's Extract Co.; 72 bg. bees, Southampton, Order; 278 bg. carnauba, Ceara, Order; 72 bg. do., Ceara, Lazard Freres.

WOOL GREASE—32 bbl., Hamburg, Schenkers, Inc.; 120 bbl., Antwerp, International Harvester Co.; 5 bbl., Antwerp, A. Klipstein & Co.; 90 bbl., Antwerp, Order; 12 bbl., Liverpool. Elbert & Co.

ZINC OXIDE—57 csk., Hamburg, Order; 200 csk., Antwerp, E. M. & F. Waldo; 135 bbl., Antwerp, Philipp Bros.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums	lb.	$0.25 –	$0.25½
Acetic anhydride, 85%, dr.	lb.	.38 –	....
Acid, acetic, 28%, bbl.	100 lb.	3.38 –	3.63
Acetic, 56%, bbl	100 lb.	6.75 –	7.00
Acetic, 80%, bbl.	100 lb.	9.58 –	9.83
Glacial, 99½%, bbl.	100 lb.	12.00 –	12.78
Boric, bbl.	lb.	.10 –	....
Citric, kegs	lb.	.46½ –	.48
Formic, 85%	lb.	.12 –	.14
Gallic, tech.	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl.	lb.	.11½ –	.12
22% tech., light, bbl.	lb.	.05½ –	.06
Muriatic, 18° tanks	100 lb.	.90 –	1.00
Muriatic, 20°, tanks	100 lb.	1.00 –	1.10
Nitric, 36°, carboys	lb.	.04½ –	.05
Nitric, 42°, carboys	lb.	.05¼ –	.05½
Oleum, 20%, tanks	ton	18.50 –	19.00
Oxalic, crystals, bbl.	lb.	.12 –	.12¼
Phosphoric, 50% carboys	lb.	.07½ –	.08½
Pyrogallic, resublimed	lb.	1.50 –	1.60
Sulphuric, 60°, tanks	ton	9.00 –	11.00
Sulphuric, 60°, drums	ton	13.00 –	14.00
Sulphuric, 66°, tanks	ton	15.00 –	16.00
Sulphuric, 66° drums	ton	20.00 –	21.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.27 –	.27½
Tartaric, domestic, bbl.	lb.	.30 –	....
Tungstic, per lb.	lb.	1.20 –	1.25
Alcohol, butyl, drums, f.o.b. works	lb.	.26 –	.28
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.81 –	....
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.78 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl.	gal.	.51½ –	...
No. 1, 190 proof, special, dr.	gal.	.45½ –	...
No. 1, 188 proof, bbl	gal.	.52½ –	...
No. 1, 188 proof, dr	gal.	.48½ –	...
No. 5, 188 proof, bbl.	gal.	.50½ –	...
No. 5, 188 proof, dr	gal.	.44½ –	...
Alum, ammonia, lump, bbl.	lb.	.03½ –	.04
Potash, lump, bbl.	lb.	.03 –	.03½
Chrome, lump, potash, bbl.	lb.	.05½ –	.06
Aluminum sulphate, com., bags	100 lb.	1.40 –	1.50
Iron free bags	lb.	2.40 –	2.50
Aqua ammonia, 26°, drums	lb.	.07 –	.07½
Ammonia, anhydrous, cyl.	lb.	.30 –	.30½
Ammonium carbonate, powd. tech., casks	lb.	.09 –	.09½
Ammonium nitrate, tech., casks	lb.	.09 –	.10
Amyl acetate tech., drums	gal.	4.50 –	4.75
Antimony oxide, white, bbl.	lb.	.07½ –	.07¾
Arsenic, white, powd., bbl.	lb.	.13¼ –	.13¾
Arsenic, red, powd., kegs	lb.	.15 –	.15½
Barium carbonate, bbl.	ton	68.00 –	72.00
Barium chloride, bbl.	ton	85.00 –	90.00
Barium dioxide, 88%, drums	lb.	.17½ –	.18
Barium nitrate, casks	...	.07¾ –	.08
Blanc fixe, dry, bbl.	lb.	.04 –	.04¼
Bleaching powder, f.o.b. wks., drums	100 lb.	1.25 –	....
Spot N. Y. drums	100 lb.	1.75 –	....
Borax, bbl.	lb.	.05¼ –	.05½
Bromine, cases	lb.	.28 –	.30
Calcium acetate, bags	100 lb.	4.00 –	4.05
Calcium arsenate, dr.	lb.	.11½ –	.12½
Calcium carbide, drums	lb.	.05 –	.05¼
Calcium chloride, fused, dr. wks.	ton	21.00 –	....
Gran. drums works	ton	27.00 –	....
Calcium phosphate, mono, bbl.	lb.	.06½ –	.07
Camphor, cases	lb.	.84 –	.85
Carbon bisulphide, drums	lb.	.06 –	.06½
Carbon tetrachloride, drums	lb.	.09 –	.09½
Chalk, precip.—domestic, light, bbl.	lb.	.04¼ –	.04½
Domestic, heavy, bbl.	lb.	.03¾ –	.04
Imported, light, bbl.	lb.	.04½ –	.05
Chlorine, liquid, tanks, wks.	lb.	.04 –	.04¼
Contract, tanks, wks.	lb.	.03 –	....
Cylinders, 100 lb., wks.	lb.	.05½ –	.06
Cylinders, 100 lb., spot	lb.	.08½ –	.09
Chloroform, tech., drums	lb.	.30 –	.32
Cobalt, oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	18.00 –	19.00
Copper carbonate, bbl.	lb.	.18 –	.19
Copper cyanide, drums	lb.	.47 –	.50
Coppersulphate, dom., bbl.	100 lb.	4.75 –	4.90
Imp bbl.	100 lb.	4.50 –	....
Cream of tartar bbl.	lb.	.22½ –	.25½
Epsom salt, dom., tech., bbl.	100 lb.	1.75 –	2.00
Epsom salt, imp., tech., bags	100 lb.	1.00 –	1.05
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.25 –	2.50
Ether, U.S.P., resale, dr.	lb.	.13 –	.15
Ethyl acetate, 85%, drums.	gal.	.97 –	....
Ethyl acetate, 99%, dr.	gal.	$1.12 –	$1.15
Formaldehyde, 40%, bbl.	lb.	.10½ –	.10¾
Fullers earth—f.o.b. mines	ton	18.00 –	20.00
Fusel oil, ref., drums	gal.	.... –	....
Fusel oil, crude, drums	gal.	4.00 –	4.25
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	.90 –	.95
Glycerine, c.p., drums extra	lb.	.16½ –	.17
Glycerine, dynamite, drums	lb.	.16 –	....
Glycerine, crude 80%, loose	lb.	.10½ –	....
Iron oxide, red, casks	lb.	.12 –	.18
Lead:			
White, basic carbonate, dry, casks	lb.	.09½ –	.09¾
White, basic sulphate, casks	lb.	.08½ –	.09
White, in oil, kegs	lb.	.11½ –	.11¾
Red, dry, casks	lb.	.10½ –	.10¾
Red, in oil, kegs	lb.	.13 –	.14½
Lead acetate, white crys., bbl.	lb.	.14 –	.14½
Brown, broken, casks	lb.	.13 –	.13½
Lead arsenate, powd., bbl.	lb.	.18 –	.20
Lime-Hydrated, bg, wks.	ton	10.50 –	12.50
Bbl., wks.	ton	18.00 –	19.00
Lime, Lump, bbl.	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.10½ –	.10¾
Lithopone, bags	lb.	.06½ –	.06¾
in bbl.	lb.	.06½ –	.06¾
Magnesium carb., tech., bags	lb.	.08½ –	.08¾
Methanol, 95%, bbl.	gal.	.93 –	....
Methanol, 97%, bbl.	gal.	.95 –	....
Methanol, pure, tanks	gal.	.90 –	....
drums	gal.	1.00 –	....
bbl.	gal.	1.05 –	....
Methyl-acetone, t'ks.	gal.	1.15 –	....
Nickel salt, double, bbl.	lb.	.10 –	.10½
Nickel salts, single, bbl.	lb.	.11 –	.11½
Phosgene	....	.60 –	.75
Phosphorus, red, cases	lb.	.... –	....
Phosphorus, yellow, cases	lb.	.35 –	.40
Potassium bichromate, casks	lb.	.09½ –	....
Potassium bromide, gran., bbl.	lb.	.19 –	.20
Potassium carbonate, 80-85%, calcined, casks	lb.	.06½ –	.06¾
Potassium chlorate, powd.	lb.	.07½ –	.08½
Potassium cyanide, drums	lb.	.47 –	.52
Potassium, first sorts, cask	lb.	.08½ –	.08¾
Potassium hydroxide (caustic potash) drums	lb.	.06½ –	.06¾
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl.	lb.	.07½ –	.09
Potassium permanganate, drums	lb.	.14 –	.14½
Potassium prussiate, red, casks	lb.	.45 –	.48
Potassium prussiate, yellow, casks	lb.	.22 –	.23
Salammoniac, white, gran., casks, imported	lb.	.06½ –	.06¾
Salammoniac, white, gran., bbl., domestic	lb.	.07½ –	.07¾
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1.20 –	1.40
Salt cake (bulk)	ton	24.00 –	26.00
Soda ash, light, 58% flat, bulk, contract	100 lb.	1.25 –	....
bags, contract	100 lb.	1.38 –	....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 –	....
bags, contract	100 lb.	1.45 –	....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 –	....
Soda, caustic, ground and flake, contracts, dr.	100 lb.	3.50 –	3.85
Soda, caustic, solid, 76% f.a.s. N. Y.	100 lb.	3.10 –	....
Sodium acetate, works, bbl.	lb.	.05 –	.05½
Sodium bicarbonate, bulk	100 lb.	1.75 –	....
330-lb. bbl.	100 lb.	2.00 –	....
Sodium bichromate, casks	lb.	.07½ –	.07¾
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½ –	.04¾
Sodium chlorate, kegs	lb.	.06½ –	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.19 –	.22
Sodium fluoride, bbl.	lb.	$0.08½ –	$0.10½
Sodium hyposulphite, bbl.	lb.	.02½ –	.02¾
Sodium nitrite, casks	lb.	.07½ –	.07¾
Sodium peroxide, powd., cases	lb.	.28 –	.30
Sodium phosphate, dibasic, bbl.	lb.	.03½ –	.04
Sodium prussiate, yel. drums	lb.	.11½ –	.11¾
Sodium salicylic, drums	lb.	.40 –	.42
Sodium silicate (40°, drums)	100 lb.	.75 –	1.15
Sodium silicate (60°, drums)	100 lb.	1.75 –	2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03 –	.03½
Sodium sulphite, crys., bbl.	lb.	.03½ –	.03¾
Strontium nitrate, powd., bbl.	lb.	.11½ –	.12
Sulphur chloride, yel drums	lb.	.04½ –	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 –	.08
Tin bichloride, bbl.	lb.	.13½ –	.13¾
Tin oxide, bbl.	lb.	.51 –	....
Tin crystals, bbl.	lb.	.34½ –	.35
Zinc carbonate, bags	lb.	.14 –	.14½
Zinc chloride, gran, bbl.	lb.	.06½ –	.06¾
Zinc cyanide, drums	lb.	.37 –	.38
Zinc oxide, lead free, bag	lb.	.06½ –	.06¾
5% lead sulphate, bags	lb.	.06½ –	.07½
10 to 35% lead sulphate, bags	lb.	.06½ –	.06¾
French, red seal, bags	lb.	.09½ –	.....
French, green seal, bags	lb.	.10½ –	.....
French, white seal, bbl.	lb.	.12 –	.....
Zinc sulphate, bbl.	100 lb.	2.75 –	3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 –	$0.70
Alpha-naphthol, ref., bbl.	lb.	.65 –	.80
Alpha-naphthylamine, bbl.	lb.	.35 –	.36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salts, bbl.	lb.	.22 –	.23
Anthracene, 80%, drums	lb.	.75 –	.80
Anthracene, 80%, imp., drums, duty paid	lb.	.65 –	.70
Anthraquinone, 25%, paste, drums	lb.	.75 –	.80
Benzaldehyde U.S.P., carboys	lb.	1.50 –	.....
f.f.c. drums	lb.	1.60 –	.....
tech, drums	lb.	75	...
Benzene, pure, water-white, tanks, works	gal.	.22½ –	.23
Benzene, 90%, tanks, works	gal.	.21 –	....
Benzidine base, bbl.	lb.	.82 –	.86
Benzidine sulphate, bbl.	lb.	.72 –	.75
Benzoic acid, U.S.P., kegs	lb.	.85 –	.88
Benzoate of soda, U.S.P., bbl.	lb.	.65 –	.70
Benzyl chloride, 95-97%, ref., carboys	lb.	.40 –	....
Benzyl chloride, tech., drums	lb.	.25 –	....
Beta-naphthol, tech., bbl.	lb.	.25 –	.26
Beta-naphthylamine, tech.	lb.	.75 –	.80
Cresol, U.S.P., drums	lb.	.25 –	.29
Ortho-cresol, drums	lb.	.28 –	.32
Cresylic acid, 97%, works drums	gal.	.75 –	.85
95-97%, drums, works	gal.	.70 –	.75
Dichlorbenzene, drums	lb.	.06 –	.08
Diethylaniline, drums	lb.	.49 –	.53
Dimethylaniline, drums	lb.	.39 –	.40
Dinitrobenzene, bbl.	lb.	.18 –	.20
Dinitrochlorbenzene, bbl.	lb.	.21 –	.22
Dinitronaphthalen, bbl.	lb.	.30 –	.32
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluen, bbl.	lb.	.20 –	.22
Dip oil, 25%, drums	gal.	.30 –	.33
Diphenylamine, bbl.	lb.	.50 –	.52
H-acid, bbl.	lb.	.75 –	.80
Meta-phenylenediamine, bbl.	lb.	1.00 –	1.05
Michlers ketone, bbl.	lb.	3.00 –	3.50
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	.95 –	1.10
Naphthalene, flake, bbl.	lb.	.06 –	.06½
Naphthalene, balls, bbl.	lb.	.06½ –	.07
Naphthionate of soda, bbl.	lb.	.60 –	.65
Naphthionic acid, crude, bbl.	lb.	.55 –	.60
Nitrobenzene, drums	lb.	.09½ –	.10
Nitro-naphthalene, bbl.	lb.	.30 –	.35
Nitro-toluene, drums	lb.	.13½ –	.14
N-W acid, bbl.	lb.	1.10 –	1.15
Ortho-amidophenol, kegs	lb.	2.30 –	2.35
Ortho-dichlorbenzene, drums	lb.	.15 –	.17
Ortho-nitrophenol, bbl.	lb.	1.20 –	1.30
Ortho-nitrotoluene, drums	lb.	.11 –	.12
Ortho-toluidine, bbl.	lb.	.14 –	.16
Para-amidophenol, base, kegs	lb.	1.30 –	.....
Para-amidophenol, HCl, kegs	lb.	1.55 –	.....
Para-dichlorbenzene, bbl.	lb.	.17 –	.20
Paranitroaniline, bbl.	lb.	.70 –	.73
Para-nitrotoluene, bbl.	lb.	.60 –	.65
Para-phenylenediamine, bbl.	lb.	1.45 –	1.50
Para-toluidine, bbl	lb.	.90 –	.95
Phthalic anhydride, bbl.	lb.	.30 –	.34
Phenol, U.S.P., dr.	lb.	.26 –	.34
Picric acid, bbl.	lb.	.20 –	.22
Pyridine, dom., drums	gal.	nominal	
Pyridine, imp., drums	gal.	4.00 –	4.25
Resorcinol, tech., kegs	lb.	1.40 –	1.50

Resorcinol, pure, kegs	lb.	$2.15 – ....
R-salt, bbl	lb.	.55 – .60
Salicylic acid, tech., bbl	lb.	.32 – ....
Salicylic acid, U.SP., bbl	lb.	.35 – ....
Solvent naphtha, water-white, tanks	gal.	.23 – ....
Crude, tanks	gal.	.20 – ....
Sulphanilic acid, crude, bbl	lb.	.18 – .20
Thiocarbanilide, kegs	lb.	.35 – .38
Tolidine, bbl	lb.	1.00 – 1.05
Toluidine, mixed, kegs	lb.	.30 – .35
Toluene, tank cars, works	gal.	.24 – ....
Toluene, drums, works	gal.	.29 – ....
Xylidine, drums	lb.	.50 – ....
Xylene, pure, drums	gal.	.45 – .50
Xylene, com., drums	gal.	.34 – ....
Xylene, com., tanks	gal.	.29 – ....

Naval Stores

Rosin B-D, bbl	280 lb.	$5.70 – ....
Rosin E-I, bbl	280 lb.	5.70 – ....
Rosin K-N, bbl	280 lb.	5.80 – $6.00
Rosin W.G.-W.W., bbl	280 lb.	6.80 – 7.10
Wood rosin, bbl	280 lb.	5.80 – 5.90
Turpentine, spirits of, bbl	gal.	.92½ – ....
Wood, steam dist., bbl	gal.	.85 – ....
Wood, dest. dist., bbl	gal.	.70 – ....
Pine tar pitch, bbl	200 lb.	5.50 – ....
Tar, kiln burned, bbl	500 lb.	11.00 – ....
Retort tar, bbl	500 lb.	11.00 – ....
Rosin oil, first run, bbl	gal.	.45 – ....
Rosin oil, second run, bbl	gal.	.47 – ....
Rosin oil, third run, bbl	gal.	.50 – ....
Pine oil, steam dist.	gal.	.65 – ....
Pine oil, pure, dest. dist.	gal.	.60 – ....
Pine tar oil, ref.	gal.	.48 – ....
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla.	gal.	.32 – .32½
Pine tar oil, double ref., bbl	gal.	.... – .75
Pine tar, ref., thin, bbl	gal.	.... – .25
Pinewood creosote, ref., bbl.	gal.	.... – .52

Animal Oils and Fats

Degras, bbl	lb.	$0.04 – $0.04¼
Grease, yellow, loose	lb.	.06½ – .06¾
Lard oil, Extra No. 1, bbl	gal.	.85 – ....
Neatsfoot oil 20 deg. bbl	gal.	1.30 – ....
No. 1, bbl	gal.	.98 – ....
Oleo Stearine		.10½ – .10¾
Oleo oil, No. 1, bbl	lb.	.16½ – .16¾
Red oil, distilled, d.p. bbl	lb.	.08½ – .08¾
Saponified bbl	lb.	.08½ – .08¾
Tallow, extra, loose	lb.	.08 – ....
Tallow oil, acidless, bbl	gal.	.86 – .88

Vegetable Oils

Castor oil, No. 3, bbl	lb.	$0.14 – ....
Castor oil, No. 1, bbl	lb.	.14½ – ....
Chinawood oil, bbl	lb.	.21 – .21½
Coconut oil, Ceylon, bbl	lb.	.09½ – ....
Ceylon, tanks, N.Y.	lb.	.08½ – ....
Coconut oil, Cochin, bbl	lb.	.10 – ....
Corn oil, crude, bbl	lb.	.12 – ....
Crude, tanks, (f.o.b. mill)	lb.	.09½ – ....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09½ – .09¾
Summer yellow, bbl	lb.	.11½ – .12½
Winter yellow, bbl	lb.	.13 – .13½
Linseed oil, raw, car lots, bbl.	gal.	.90 – ....
Raw, tank cars (dom.)	gal.	.84 – ....
Boiled, cars, bbl. (dom.)	gal.	.92 – ....
Olive oil, denatured, bbl	gal.	1.10 – 1.12
Sulphur, (foots) bbl	lb.	.09½ – .09¾
Palm, Lagos, casks	lb.	.07½ – ....
Niger, casks	lb.	.06½ – .07
Palm kernel, bbl	lb.	.09 – ....
Peanut oil, crude, tanks (mill)	lb.	.12 – ....
Peanut oil, refined, bbl	lb.	.15 – .15½
Perilla, bbl	lb.	.14½ – .14¾
Rapeseed oil, refined, bbl	gal.	.76 – ....
Rapeseed oil, blown, bbl	gal.	.83 – .85
Sesame, bbl	lb.	.12½ – .12¾
Soya bean (Manchurian), bbl.	lb.	....
Tank, f.o.b. Pacific coast	lb.	.10 – ....
Tank, (f.o.b. N.Y.)	lb.	.10½ – ....

Fish Oils

Cod, Newfoundland, bbl	gal.	$0.68 – ....
Menhaden, light pressed, bbl.	gal.	.64 – ....
White bleached, bbl	gal.	.66 – ....
Blown, bbl	gal.	.70 – ....
Crude, tanks (f.o.b. factory)	gal.	.47½ – ....
Whale No. 1 crude, tanks, coast	lb.	.... – ....
Winter, natural, bbl	gal.	.75 – .76
Winter, bleached, bbl	gal.	.78 – .79

Oil Cake and Meal

Coconut cake, bags	ton	$34.00 – ....
Cottonseed meal, f.o.b. mills	ton	45.00 – ....
Linseed cake, bags	ton	41.00 – 42.00
Linseed meal, bags	ton	44.00 – ....

Dye & Tanning Materials

Albumen, blood, bbl	lb.	$0.45 – $0.50
Albumen, egg, tech, kegs	lb.	.95 – .97
Cochineal, bags	lb.	.32 – .34
Cutch, Borneo, bales	lb.	.04½ – .04¾
Cutch, Rangoon, bales	lb.	.15 – .16
Dextrine, corn, bags	100 lb.	3.59 – 3.69
Dextrine, gum, bags	100 lb.	3.89 – 3.99
Divi-divi, bags	ton	38.00 – 39.00
Fustic, sticks	ton	30.00 – 35.00
Fustic, chips, bags	lb.	.04 – .05
Gambier com., bags	lb.	.10½ – .10¾
Logwood, sticks	ton	25.00 – 26.00
Logwood, chips, bags	lb.	.02½ – .03
Sumac, leaves, Sicily, bags	ton	90.00 – ....
Sumac, ground, bags	ton	$85.00 – $90.00
Sumac, domestic, bags	ton	40.00 – 42.00
Starch, corn, bags	100 lb.	3.02 – 3.12
Tapioca flour, bags	lb.	.06 – .07

Extracts

Archil, conc., bbl	lb.	$0.16½ – $0.20
Chestnut, 25% tannin, tanks.	lb.	.02 – .03
Divi-divi, 25% tannin, bbl	lb.	.04 – .05
Fustic, crystals, bbl	lb.	.20 – .22
Fustic, liquid, 42°, bbl	lb.	.08 – .09
Gambier, liq., 25% tannin, bbl.	lb.	.09 – .09½
Hematine crys., bbl	lb.	.14 – .18
Hemlock, 25% tannin, bbl	lb.	.03½ – .04
Hypernic, solid, drums	lb.	.24 – .26
Hypernic, liquid, 51°, bbl	lb.	.09½ – .10½
Logwood, crys., bbl	lb.	.14 – .15
Logwood, liq., 51°, bbl	lb.	.07½ – .08
Quebracho, solid, 65% tannin, bbl	lb.	.05 – .05¼
Sumac, dom., 51°, bbl	lb.	.06½ – .07½

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.08 – $0.10
spot, cases	lb.	.10 – .14
Lampblack, bbl	lb.	.12 – .40
Mineral, bulk	ton	35.00 – 45.00
Blues–Bronze, bbl	lb.	.45 – .50
Prussian, bbl	lb.	.45 – .50
Ultramarine, bbl	lb.	.08 – .35
Browns, Sienna, Ital., bbl	lb.	.06 – .14
Sienna, Domestic, bbl	lb.	.03½ – .04
Umber, Turkey, bbl	lb.	.04 – .04½
Greens–Chrome, C.P. Light, bbl	lb.	.28 – .30
Chrome, commercial, bbl	lb.	.12 – .12½
Paris, bulk	lb.	.26 – .28
Reds Carmine No. 40, tins	lb.	4.50 – 4.70
Oxide red, casks	lb.	.10 – .14
Para toner, kegs	lb.	1.00 – 1.10
Vermilion, English, bbl	lb.	1.15 – 1.20
Yellow, Chrome, C.P. bbls	lb.	.17½ – .18
Ocher, French, casks	lb.	.02½ – .03

Waxes

Bayberry, bbl	lb.	$0.25 – $0.26
Beeswax, crude, Afr. bg.	lb.	.22 – ....
Beeswax, refined, light, bags	lb.	.32 – .34
Beeswax, pure white, cases	lb.	.40 – .41
Candellila, bags	lb.	.23 – .23½
Carnauba, No. 1, bags	lb.	.36 – .38
No. 2, North Country, bags	lb.	.22 – .22½
No. 3, North Country, bags	lb.	.18½ – .19
Japan, cases	lb.	.16½ – .16¾
Montan, crude, bags	lb.	.05½ – .06
Paraffine, crude, match, 105-110 m.p., bbl	lb.	.04½ – ....
Crude, scale 124-126 m.p. bags	lb.	.03¾ – ....
Ref., 118-120 m.p., bags	lb.	.04 – ....
Ref., 125 m.p., bags	lb.	.04¼ – ....
Ref. 128-130 m.p., bags	lb.	.04½ – ....
Ref., 133-135 m.p., bags	lb.	.04¾ – .05
Ref., 135-137 m.p., bags	lb.	.05½ – ....
Stearic acid, sgle pressed, bags	lb.	.11½ – .11¾
Double pressed, bags	lb.	.12 – .12½
Triple pressed, bags	lb.	.13½ – .13¾

Fertilizers

Acid phosphate, 16%, bulk, works	ton	$8.00 – $8.25
Ammonium sulphate, bulk f.o.b. works	100 lb.	2.85 – 2.90
Blood, dried, bulk	unit	4.10 – 4.15
Bone, raw, 3 and 50, ground	ton	26.00 – 28.00
Fish scrap, dom., dried, wks.	unit	4.40 – ....
Nitrate of soda, bags	100 lb.	2.50 – ....
Tankage, high grade, f.o.b. Chicago	unit	3.25 – 3.35
Phosphate rock, f.o.b. mines, Florida pebble, 68-72%	ton	4.00 – 4.50
Tennessee, 78-80%	ton	7.75 – 8.00
Potassium muriate, 80%, bags	ton	34.55 – ....
Potassium sulphate, bags basis 90%	ton	45.85 – ....
Double manure salt	ton	27.00 – ....
Kainit	ton	7.22 – ....

Crude Rubber

Para—Upriver fine	lb.	$0.22½ – ....
Upriver coarse	lb.	.18½ – ....
Upriver caucho ball	lb.	.20 – ....
Plantation—First latex crepe	lb.	.27 – ....
Ribbed smoked sheets	lb.	.26½ – ....
Brown crepe, thin, clean	lb.	.24½ – ....
Amber crepe No. 1	lb.	.25½ – ....

Gums

Copal, Congo, amber, bags	lb.	$0.10 – $0.15
East Indian, bold, bags	lb.	.21 – .22
Manila, pale, bags	lb.	.19 – .20
Pontinak, No. 1 bags	lb.	.19 – .20
Damar, Batavia, cases	lb.	.25 – ....
Singapore, No. 1, cases	lb.	.32 – .33
Singapore, No. 2, cases	lb.	.21½ – .22
Kauri, No. 1, cases	lb	.64 – .66
Ordinary chips, cases	lb.	.21 – .23
Manjak, Barbados, bags	lb.	.09 – .14

Shellac

Shellac, orange fine, bags	lb.	$0.64 – ....
Orange superfine, bags	lb.	.66 – ....
A. C. garnet, bags	lb.	.65 – ....
Bleached, bonedry	lb.	.72 – .73
Bleached, fresh	lb.	.60 – ....
T. N., bags	lb.	.59 – .60

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b. Quebec	sh. ton	$350.00 – $450.00
Asbestos, shingle, f.o.b., Quebec	sh. ton	50.00 – 60.00
Asbestos, cement, f.o.b., Quebec	sh. ton	17.00 – 20.00
Barytes, grd., white, f.o.b. mills, bbl	net ton	15.00 – 18.00
Barytes, grd., off-color, f.o.b. Balt.	net ton	13.00 – 14.00
Barytes, floated, f.o.b. St. Louis, bbl	net ton	26.00 – .....
Barytes, crude f.o.b. mines, bulk	net ton	7.00 – 10.00
Casein, bbl., tech	lb.	.11 – .12
China clay (kaolin) crude, f.o.b. Ga	net ton	6.00 – 8.00
Washed, f.o.b. Ga	net ton	8.00 – 9.00
Powd., f.o.b. Ga	net ton	14.00 – 20.00
Crude f.o.b. Va	net ton	6.00 – 8.00
Ground, f.o.b. Va	net ton	13.00 – 19.00
Imp., lump, bulk	net ton	15.00 – 20.00
Imp., powd	net ton	45.00 – 50.00
Feldspar, No. 1 f.o.b. N.C.	long ton	6.60 – 7.75
No. 2 f.o.b. N.C.	long ton	4.50 – 5.00
No. 1 soap	long ton	8.50 – ....
No. 1 Canadian, f.o.b. mill, powd	long ton	20.00 – ....
Graphite, Ceylon, lump, first quality, bbl	lb.	.06 – .06½
Ceylon, chip, bbl	lb.	.04½ – .07
High grade amorphous crude	ton	15.00 – 30.00
Gum arabic, amber, sorts, bags	lb.	.13 – .13½
Gum tragacanth, sorts, bags	lb.	.50 – .55
No. 1, bags	lb.	1.35 – 1.40
Kieselguhr, f.o.b. Cal	ton	40.00 – 42.00
F.o.b. N. Y	ton	50.00 – 55.00
Magnesite, crude, f.o.b. Cal	ton	14.00 – 15.00
Pumice stone, imp., casks	lb.	.03 – .05½
Dom., lump, bbl	lb.	.05 – .05½
Dom., ground, bbl	lb.	.05½ – .06
Silica, glass sand, f.o.b. Ind.	ton	2.00 – 2.50
Silica, sand blast, f.o.b. Ind.	ton	2.50 5.00
Silica, amorphous, 200-mesh, f.o.b. Ill.	ton	20.00 – ....
Silica, glass sand, f.o.b. Ill.	ton	1.50 – 3.00
Soapstone, coarse, f.o.b. Vt., bags	ton	7.00 – 8.00
Talc, 200 mesh, f.o.b., Vt., bags, extra	ton	6.50 – 8.50
Talc, 200 mesh, f.o.b. Ga., bags	ton	7.00 – 9.00
Talc, 350 mesh, f.o.b. New York, grade A bags	ton	22.00 – ....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$2.85 – $3.10
Corning	bbl.	1.40 – ......
Cabell	bbl.	1.35 – ......
Somerset	bbl.	1.30 – ......
Illinois	bbl.	1.32 – ......
Indiana	bbl.	1.33 – ......
Kansas and Okla. under 28deg.	bbl.	.40 – ......
California, 35 deg. and up	bbl.	.76 – ......

Gasoline, Etc.

Motor gasoline, steel bbls	gal.	$0.15½ – ......
Naphtha, V. M. & P. deod, steel bbls	gal	.14½ – ......
Kerosene, ref. tank wagon	gal.	.15 – ......
Bulk, W.W. delivered, N.Y.	gal.	.09½ – ......
Lubricating oils:		
Cylinder, Penn., dark	gal.	.25 – ....
Bloomless, 30@31 grav	gal.	.17½ – ....
Paraffin, pale	gal.	.16½ – .17
Spindle, 200, pale	gal.	.21 – .21½
Petrolatum, amber, bbls	lb.	.03½ – .04
Paraffine wax (see waxes)		

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140–145
Chrome brick, f.o.b. Eastern shipping points	ton	50–52
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	42–45
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	35–38
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	50–53
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	50–53
F.o.b. Mt. Union, Pa.	1,000	42–45
Silicon carbide refract. brick, 9-in.	1,000	1180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N. Y.	ton	$200.00 – $225.00

Ferrochromium, per lb. of Cr, 1-2% C	lb.	$0.28 –	$0.30
4-6% C	lb.	.12 –	....
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	109.00 –	....
Spiegeleisen, 19-21% Mn	gr. ton	40.00 –	....
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	2.00 –	2.50
Ferrosilicon, 10-12%	gr. ton	43.00 –	50.00
50%	gr. ton	82.50 –	85.00
Ferrotungsten, 70-80%, per lb. of W	lb.	.88 –	.90
Ferro-uranium, 35-50% of U. per lb. of U	lb.	4.50 –	....
Ferrovanadium, 30-40%, per lb. of V	lb.	3.50 –	4.50

Ores and Semi-finished Products

Bauxite, dom. crushed dried, f.o.b. shipping points	ton	$5.50 –	$8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 –	23.00
C.i.f. Atlantic seaboard	ton	19.25 –	22.00
Coke, fdry., f.o.b. ovens	ton	5.00 –	5.50
Coke, furnace, f.o.b. ovens	ton	3.85 –	4.00
Fluorspar, gravel, f.o.b. mines' Illinois	ton	23.50 –	....
Ilmenite, 52% TiO_2	lb.	.00½–	.01
Manganese ore, 50% Mn c.i.f. Atlantic seaport	unit	.38 –	.42
Manganese ore, chemical (MnO_2)	ton	75.00 –	80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.80 –	....
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f Atl. seaport	unit	.11½–	.12
Pyrites, Span., furnace size c.i.f. Atl. seaport	unit	.11½–	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 –	....
Rutile, 95% TiO_2	lb.	.10 –	....
Tungsten, scheelite, 60% WO_3 and over	unit	9.50 –	10.00
Tungsten, wolframite, 60% WO_3	unit	9.00 –	9.50
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	2.25 –	2.50
Vanadium pentoxide, 99%	lb.	12.00 –	14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 –	1.25
Zircon	ton	80.00 –	....

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.12⅞–$0.13
Aluminum, 98 to 99%	lb.	.26 – .27
Antimony, wholesale, Chinese and Japanese	lb.	.09⅞– .10⅛
Nickel, 99%	lb.	.27 – .30
Monel metal, shot and blocks	lb.	.32
Monel metal, ingots	lb.	.38
Monel metal, sheet bars	lb.	.45
Tin, 5-ton lots, Straits	lb.	.4720
Lead, New York, spot	lb.	7.40
Lead, E. St. Louis, spot	lb.	7.50
Zinc, spot, New York	lb.	.0655
Zinc, spot, E. St. Louis	lb.	.0625
Silver (commercial)	oz.	.64⅛
Cadmium	lb.	.75@.80
Bismuth (500 lb. lots)	lb.	2.55
Cobalt	lb.	3.00-3.25
Magnesium, ingots, 99%	lb.	1.25–.....
Platinum	oz.	125.00
Iridium	oz.	275.00–300.00
Palladium	oz.	83.00
Mercury	75 lb.	60.00
Tungsten	lb.	.95–1.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	19.50
Copper bottoms	29.75
Copper rods	19.75
High brass wire	18.00
High brass rods	15.75
Low brass wire	20.25
Low brass rods	20.50
Brazed brass tubing	23.50
Brazed bronze tubing	27.00
Seamless copper tubing	25.50
Seamless high brass tubing	24.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

Copper, heavy and crucible	9.00@ 9.50
Copper, heavy and wire	10.25@10.50
Copper, light and bottoms	8.50@ 8.75
Lead, heavy	5.50@ 5.62½
Lead, tea	3.50@ 3.75
Brass, heavy	6.00@ 6.25
Brass, light	5.25@ 5.50
No. 1 yellow brass turnings	5.75@ 6.00
Zinc scrap	3.75@ 4.00

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.54	$3.54
Soft steel bars	3.54	3.54
Soft steel bar shapes	3.54	3.54
Soft steel bands	4.39	4.39
Plates, ¼ to 1 in. thick	3.64	3.64

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Arkansas

GRAVETTE—Frederick Keeler is perfecting plans for the establishment of a local tanning plant in existing building. It is purposed to install equipment at an early date.

California

LOS ANGELES—The Pioneer Paper Co., 247 South Los Angeles St., has acquired a tract of about 2¼ acres of land adjoining its present plant at Alameda and 55th Sts., and plans for the construction of an addition on a portion of the site, estimated to cost about $50,000.

CHINESE CAMP (Tuolumne County)—John P. Maxwell and Henry R. Vail, both of Oakland, Calif., have perfected plans for the establishment of a local plant for the manufacture of lime, utilizing magnetite ore from the Grae Eagle mines, in this same district. Machinery will be installed at once.

LOS ANGELES—The National Paper Products Co., affiliated with the Zellerbach Paper Co., 220 South Los Angeles St., has taken title to a tract of about 25 acres of land at Cudahy Station, near Los Angeles, as a site for its proposed new paper mill. Plans will be prepared at an early date for the initial units, with power house, machine shop and auxiliary structures, estimated to cost in excess of $1,500,000, with machinery. J. Y. Baruh is general manager.

Connecticut

SEYMOUR—The plant and property of the New Haven Copper Co. have been acquired by new interests. Plans are said to be under advisement for improvements and expansion, including additional equipment.

STAMFORD—The Pine Waste Products Co., Inc., Stamford, is reported to have purchased a site in Georgia, exact location temporarily withheld, to be used for the construction of a new pulp and paper mill. It is expected to consummate plans early in the coming year.

District of Columbia

WASHINGTON—Bids will be received by the United States Engineer Office, 250 Old Land Office Bldg., until Jan. 15 for the installation of a filtration plant for the District of Columbia water supply project, as per plans and specifications on file.

WASHINGTON—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Jan. 8 for a miscellaneous quantity of plastic firebrick material for Eastern and Western yards, as specified in Schedule 1714. Also, at the same time, for 18,000 sq.ft. brass wire cloth for the South Brooklyn navy yard, as set forth in Schedule 1717.

Illinois

CHICAGO—The Chicago Pottery Co., 1924 Clybourn Ave., has completed plans and will take bids at once for the erection of a new 4-story and basement building, 125x200 ft., at 1924-42 Clybourn Ave., estimated to cost $150,000. L. E. Russell, 25 North Dearborn St., is architect. F. J. Clifford is president.

Indiana

TERRE HAUTE—The Terre Haute Paper Co. has acquired the former property of the Commercial Distillery Co., including 35 acres of land, for a consideration of $35,000. The company is now operating two local mills, and will use the new site for extensions in these plants. W. G. Clark is general manager.

MUNCIE—Fire, Dec. 17, destroyed a portion of the local plant of the Hinde & Dauch Paper Co., with loss estimated at about $60,000. It is planned to rebuild. Headquarters of the company are at Sandusky, O.

MARION—The Lindley Box & Paper Co. has authorized plans for the immediate rebuilding of its local mill destroyed by fire, Dec. 17, with loss estimated at $130,000, including equipment. The new structure will provide for enlarged capacity over the previous plant, and additional machinery will be installed. L. R. Lindley is president.

Kansas

PITTSBURG—C. N. Walker and Clyde E. Ozbun are formulating plans for the construction of a new leather tanning plant on local site. It will be 2-story, estimated to cost about $35,000. It is expected to defer erection until early in the spring.

Louisiana

NEW ORLEANS—The proposed local paper board mill of the Great Southern Lumber Co., Bogalusa, La., will be constructed by the Bogalusa Paper So., an affiliated organization. The initial plant unit will be equipped for a capacity of about 75 tons per day, devoted primarily to chip board and other paper board products, used for the manufacture of containers. At a later date it is purposed to build another plant unit for the production of corrugated and solid fiber shipping cases and kindred products. The mill will cost approximately $1,000,000, with machinery. W. H. Sullivan is one of the officials of the company in charge.

Maryland

BALTIMORE—The James P. Hooper Mfg. Co., operating a local textile mill, is planning for the installation of machinery at the plant for the manufacture of artificial silk under a new process, developed by James P. Hooper, president of the company. The new product will be formed of wood pulp under special chemical treatment, and it is expected to develop a large production.

BALTIMORE—The Locke Insulator Corp., Charles and Cromwell Sts., manufacturer of high-tension porcelain insulators for electrical service, has awarded a general contract to J. Henry Miller, Inc., for the erection of a 1-story addition, 80x122 ft., to cost about $18,000. It will be equipped for a galvanizing plant. W. S. Austin, Maryland Trust Bldg., is architect and engineer.

Massachusetts

WORCESTER—The Norton Co., New Bond St., manufacturer of abrasive products, has commenced the erection of a 1-story addition to cost about $25,000, for which a general contract has been awarded to the E. J. Cross Co., 82 Foster St.

Missouri

ST. LOUIS—The Warren Steel Casting Co., 3400 Maury Ave., has awarded a general contract to the Edmund Lund Construction Co., Merchants La Clede Bldg., for the construction of its proposed 1-story foundry, 60x200 ft., at the Kingshighway and Fairview Ave., for which foundations will be laid at once. It is estimated to cost $65,000. Oliver J. Popp, Odd Fellows Building, is architect.

New Jersey

NEWARK—Adolph Segal, Philadelphia, Pa., interested in sugar refineries and properties, is negotiating with Thomas L. Raymond, director of the Newark Department of Streets and Public Improvements, for the purchase of city property at Port Newark, to be used as site for a new sugar refinery, estimated to cost in excess of $3,000,000. A company will be organized, it is stated, to operate the plant.

New York

NEW YORK—Sharp & Dohme, 41 John St., manufacturers of chemicals, have acquired property at Varick and Grand Sts., and plan for the construction of a new 6-story building. Plans will be drawn at an early date. It is purposed to remove the present works to the new location.

BUFFALO—The Board of Works will commence the immediate installation of filtration equipment at the municipal waterworks, to cost about $215,000, for which a

general contract has been awarded to the Pitt Construction Co., Buffalo.

Ohio

AKRON—The American Tire & Rubber Co. has preliminary plans under advisement for the construction of an addition to its plant for considerable increase in output.

CANTON—The Canton Tire & Rubber Co., recently organized, has acquired the local plant of the Gordon Tire & Rubber Co., which has been in receivership for a number of months past. The new company purposes to remodel and improve the structure, and will soon commence operations on a basis of about 300 tires per day. Raymond W. Kent, formerly vice-president and works manager of the Republic Rubber Corp., Youngstown, O., and A. R. McConnell, former secretary and treasurer of the Knight Tire & Rubber Co., Canton, will be officials of the new organization.

AKRON—The Marathon Tire & Rubber Co. has tentative plans for the enlargement of its plant and will install equipment for larger capacity.

Pennsylvania

PITTSBURGH—The Jones & Laughlin Steel Co. has filed plans for the erection of an addition to its soaking building at 2728 Carson St., estimated to cost approximately $25,000.

PHILADELPHIA—The Crescent Ink & Color Co., 408 Vine St., is taking bids on a general contract for the erection of a new 1- and 2-story plant at 5th and Hamilton Sts. Philip S. Tyre, 1509 Arch St., is architect. W. A. Conlan is president.

PITTSBURGH—A chemical laboratory will be installed in the new high school to be erected in the Woodlawn section, estimated to cost $400,000, for which foundations will be laid at an early date. The Board of Education is in charge.

PHILADELPHIA — E. F. Houghton & Co., 240 West Somerset St., manufacturer of lubricating oils, etc., have completed plans and will commence the construction of a new 3-story building at their plant, estimated to cost $75,000.

SUNBURY—Fire, Dec. 18, destroyed a portion of the works of the Butler Oil Co., with loss estimated at $50,000, including tanks and other equipment. It is planned to rebuild.

PHILADELPHIA—Valentine H. Smith & Co., Inc., 2nd and Green Sts., manufacturers of chemical specialties, drugs, etc., have filed plans for the construction of a 5-story addition to their plant at Spring Garden and Philip Sts., to cost approximately $70,000. Furness Evans & Co., 315 South 15th St., are architects.

PHILADELPHIA—The Publicker Commercial Alcohol Co., Swanson and Snyder Sts., has work under way on a 1-story building at its plant, for which a contract recently was awarded to Samuel Levin, 1631 South 5th St.

AMBRIDGE—The Standard Seamless Tube Co., 313 6th Ave., Pittsburgh, Pa., manufacturer of steel tubing, etc., has awarded a general contract to the McClintic-Marshall Co., Oliver Bldg., Pittsburgh, for the erection of a 1-story addition, 80x500 ft., at its Ambridge Works, to be used as a hot mill, estimated to cost $95,000.

South Dakota

SIOUX FALLS—W. H. Lyon, 316 Security Bldg., is perfecting plans for the organization of a company to establish and operate a local plant for the manufacture of tile and other burned clay products.

Texas

FORT WORTH — The Parker-Browne Co., Front and Oak Sts., manufacturer of extracts, etc., has plans for the erection of a 3-story addition to its plant, 50x160 ft., estimated to cost $85,000.

REFUGIO—The Pratt-Hewitt Syndicate has preliminary plans under way for the erection of a carbon black plant on local site, estimated to cost $235,000, including equipment. Bids will soon be asked.

DALLAS—Fire, Dec. 16, destroyed a portion of the works of the E. C. Palmer Paper Co., 407-9 Lacy St., near Wood St., with loss estimated at $150,000. The company plans either to rebuild on the same site, or to move the plant to another location. W. M. Corley is manager.

ELIASVILLE — The Hanlon Gasoline Co., Breckenridge, Tex., operated by the Chestnutt & Smith Corp., Tulsa, Okla., has acquired the local plant of the Central Gasoline Producing Co., with capacity of about 8,000 gal. of natural gasoline per day. The new owner will operate the property, and has tentative plans under way for extensions and improvements.

AUSTIN—Bonds for $300,000 have been voted for the installation of a new filtration plant at the municipal waterworks. The Board of Public Works will have plans drawn at an early date.

Vermont

WELLS RIVER—The Adams Paper Co. has construction under way on a new 1-story addition at its mill, totaling about 10,000 sq.ft. of floor space, estimated to cost $75,000. A general contract for the structure has been let to James Lowe, Woodsville, N. H. Herbert Crabtree is general manager.

Washington

VANCOUVER—The Columbia Paper Mills, Inc., will commence the immediate erection of the main unit of its proposed local pulp and paper mill, for which a general contract has been awarded to the Austin Co., Cleveland, O. It is estimated to cost $250,000, including equipment. Other buildings will be erected in the near future.

West Virginia

WARDENSVILLE—The Wardensville Paint & Mineral Co. will commence the erection of a new plant early in January to consist of a number of buildings, estimated to cost in excess of $100,000, including equipment.

Industrial Notes

L. J. BUCK, United States sales representative of British America Nickel Corp. Ltd., announces his removal to more adequate offices at 9 East 46th St., New York City.

THE CONSOLIDATED PRODUCTS CO., 15 Park Row, New York, and Newark, N. J., dealer in rebuilt equipment, has just completed its yearly expansion reorganization. Several new departments have been added, the company now specializing in chemical, oil mill, foodstuff, paint and varnish, textile, laundry, sugar, milling and drying, fertilizer and rubber machinery. A large stock of machinery is carried in its Newark, N. J., warehouse and yards which is equipped to handle, test and rebuild all types of apparatus.

New Companies

MORRIS HERRMAN & CO., INC., New York; paints, varnishes, oils, etc.; $325,000. Incorporators: E. S. Brussel, E. Blum and F. A. P. Pherson. Representative: Brussel & Beebe, 165 Broadway, New York.

CRUMP-STEELE CO., Long Beach, Calif.; refined petroleum products; $3,000,000. Incorporators: Don M. and Owen E. Crump, and Guy V. Steele. Representative: Charles La Verne Larzelere, 718-26 Pacific Southwest Bldg., Long Beach.

CROWN OIL & WAX CO., Pratt and 8th Sts., Baltimore, Md.; oils, waxes and kindred products; $500,000. Incorporators: Herbert A. Megraw, Edward E. Hargest, Jr., and Wirt A. Duvall, Jr.

MERCER PORCELAIN CO., Trenton, N. J.; porcelain products; $125,000. Incorporators: Anthony Babecki and Joseph Dydzulis. Representative: Erwin E. Marshall, 152 East State St., Trenton.

UNITED METALS SEPARATING & REFINING CO., Boston, Mass.; to operate a metal smelting and refining plant; $100,000. Horton Batchelor is president, and Ezra F. Benson, 100 Bartlett St., Somerville, Mass., treasurer.

LAUREL OIL & SUPPLY CO., Laurel, Miss.; refined oil products; $50,000. Incorporators: J. W. H. Handley and J. H. McCown, both of Laurel.

E-Z CHEMICAL CO., Wilmington, Del., care of the Delaware Registration Trust Co., 900 Market St., Wilmington, representative; to manufacture chemicals and chemical byproducts; $200,000.

THOMAS J. MCCORMICK PAPER CORP., Albany, N. Y.; paper products; 1,000 shares of stock, no par value. Incorporators: Thomas J. McCormick, E. T. Jewell and C. B. Martin. Representative: W. L. Collins, Albany, attorney.

STERLING BORAX CO., Wilmington, Del.; borax and kindred products; $600,000. Representative: Corporation Trust Co. of America, du Pont Bldg., Wilmington.

LION MATCH CO., New York; operate a match-manufacturing plant; $500,000. Incorporators: J. L. Kraus, 2d, and B. R. Hudes. Representative: Maurice Hyman, 358 5th Ave., New York.

COLLINS & WRIGHT, INC., Pittsburgh, Pa.; glassware products; $50,000. W. H. Wright, Pittsburgh, is treasurer.

LAYTON PARK FOUNDRY CO., Milwaukee, Wis.; iron, steel and other metal castings; $25,000. Incorporators: F. and J. Fischer and A. Maydock, all of Milwaukee.

IVORY MFG. CO., New Brunswick, N. J.; composition products; $125,000. Incorporators: William J. Ryan, Leo E. Gaffney and Thomas F. Boylan, 65 Peace St., New Brunswick.

QUAKER CHEMICAL CO., Wilmington, Del., care of the Colonial Charter Co., Ford Bldg., Wilmington, representative; chemicals and chemical byproducts; $50,000.

A. WOLLKIND, INC., New York; chemicals and chemical byproducts; $100,000. Incorporators: A. Wollkind, T. J. Stapleton and L. Stimel. Representative: Nathan Friedman, 309 Broadway, New York.

EASTERN OIL CORP., 20 East Lexington St., Baltimore, Md.; petroleum and petroleum byproducts; $150,000. Incorporators: Leslie G. Swartwout, Ernest E. Wooden and Gilbert B. Porter.

ROSANALINE PRODUCTS CORP., Perth Amboy, N. J.; chemicals and dyes; 2,500 shares of stock, no par value. Incorporators: Samuel E. Serels, Louis L. Karkus and Lawrence Erdmann. Representative: Karkus & Karkus, 166 Smith St., Perth Amboy.

NATIONAL BARIUM CO., Cleveland, O.; salts and mineral products; $75,000. Incorporators: Adrian D. Joyce and R. H. Horsburgh, both of Cleveland.

BINGO PRODUCTS CO., Binghamton, N. Y.; chemicals and chemical byproducts; nominal capital $5,000. Incorporators: P. J. Gorman, M. E. Finley and A. L. Herst. Representatives: Mangan & Mangan, attorneys, Binghamton.

LINCOLN FIBRE & SPECIALTY CO., Newport, Del.; fiber products; $100,000. Incorporators: John D. Taylor, Wilmington, Del.; Warren and Lincoln Taylor, both of Philadelphia, Pa.

WINNER OIL CORP., Tulsa, Okla.; petroleum products; $100,000. Incorporators: E. J. Hickey and E. G. Barnum, Winner, S. D.; and W. O. Ligon, Jr., Tulsa, Okla.

INDUSTRIES OF AMERICA, INC., Brooklyn, N. Y., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, Del., representative; chemicals and kindred products; $2,500,000. Incorporators: C. Lansing Hays, Alexander R. Kellegrew and Forrest M. Anderson, all of Brooklyn.

H. S. BROWER, INC., Richmond, N. Y.; paints, varnishes and kindred products; $40,000. Incorporators: R. H., H. S., and J. W. Brower. Representative: E. C. Sherwood, 30 East 42nd St., New York.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

BICHROMATE OF POTASH, 50 tons. Cairo, Egypt. Agency.—8682.

BORAX, caustic soda, calcium borate, and sodium bichromate. Berlin, Germany. Purchase.—8613.

CARBONATE POTASSIUM, sulphur and copper sulphate. Constantinople, Turkey. Purchase.—8660.

CHEMICALS, heavy, and oils. Milan, Italy. Agency.—8662.

CHEMISTS' SPECIALTIES. Ovan, Algeria. Agency.—8680.

DYES, in either soap, powder or liquid form. Penang, Straits Settlements. Exclusive agency.—8688.

FORMALDEHYDE. Milan, Italy. Purchase. —8585.

PAINTS. Port au Prince, Haiti. Agency. —8690.

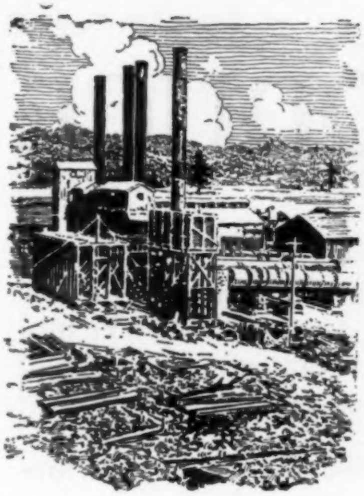
MATCH-MAKING MATERIALS. Milan, Italy. Agency.—8662.

SULPHATE OF COPPER and brown sugar of lead. Milan, Italy. Agency.—8662.

WOOD-DISTILLATION PRODUCTS. Sydney, Australia. Agency.—8637.

ROSIN. Warsaw, Poland. Purchase and agency.—8554.

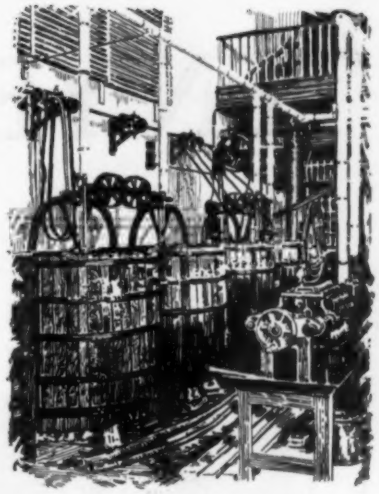
ROSIN of all grades. Basel, Switzerland Purchase.—8559.



CHEMICAL & METALLURGICAL ENGINEERING

H. C. PARMELEE
Editor

Vol. 29 — ***No.*** 27



Contents

December 31, 1923

What About 1924?

ARE we going to wish one another a "Happy New Year" and let it go at that? Are we going to start work on Jan. 2 just as though it were any other day in the year? What an opportunity we miss if we do! This should be a time for summary and forecast. In the light of the past year's experience we should plan for 1924.

Whether in your job you control hundreds of men and thousands of dollars of product or whether you are learning to operate your first manufacturing unit you owe it to yourself to take your eyes from the day's task and to focus them on the horizon. Where are you in the stream of industrial progress? Are you progressing or drifting? Is your progress sure and steady?

Chem. & Met. is dedicated to the progress of industry. Will you be in the vanguard of that progress? Will you be pointing the way to others?

Wake up, tomorrow's 1924!

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Industrial Engineer (Published in Chicago)
Electrical Retailing (Published in Chicago)
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(Published in London)

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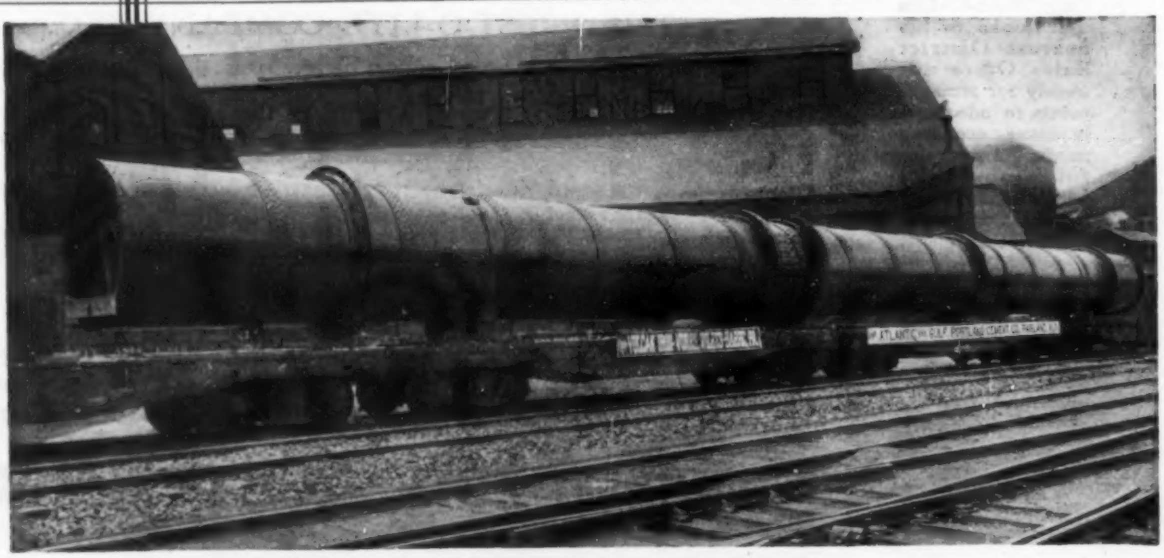

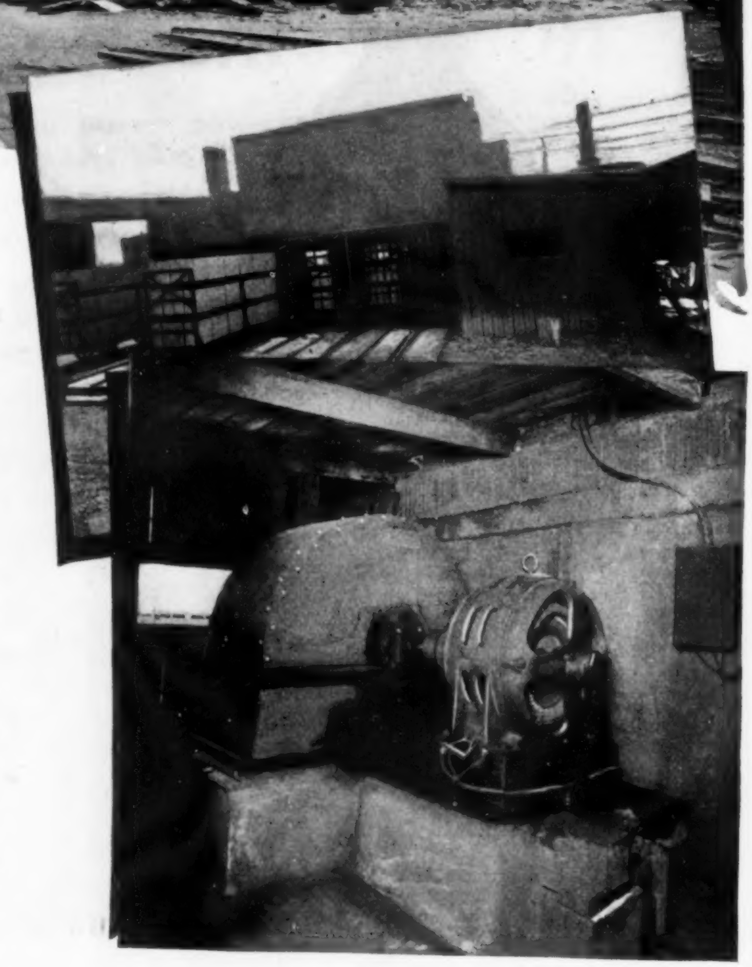

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Sturtevant Equipment utilizes the *waste heat* from the cooling kilns to dry hollow tile.

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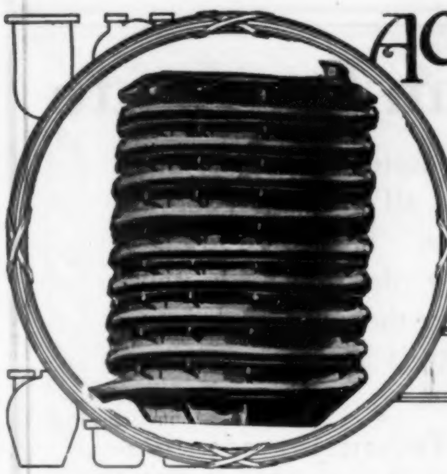

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POSITIONS VACANT

ANALYST wanted for routine work in control laboratory of established chemical plant located in New Jersey near New York. Give full qualifications, experience and salary expected in first letter. Address P-710, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

EXPERIENCED chemist wanted to take charge of chemical end of cement manufacturing laboratory. Must have executive ability. State particulars in regard to experience in first letter. P-713, Chem. & Met. Engrg., Old Colony Bldg., Chicago, Ill.

MAN wanted, experienced in cement physical laboratory work. Must have executive ability. State particulars in regard to experience in first letter. P-714, Chem. & Met. Engrg., Old Colony Bldg., Chicago, Ill.

EMPLOYMENT SERVICE

SALARIED men seeking tentative offers of new connections, are invited to communicate confidentially with the undersigned, who will negotiate overtures without jeopardy to present connections. A professional, ethical service, restricted to high grade positions; established 1910. Our "Refund Contract" guarantees refund of retaining fee to the client named therein, if service is not satisfactorily rendered and refund be requested within three months from date remitted. Send name and address only for particulars. R. W. Bixby, Inc., 706 Lockwood Building, Buffalo, New York.

POSITIONS WANTED

A DEVELOPMENT engineer, age 37, Harvard graduate school inorganic chemist, available at once; experienced by responsibilities of directorship in varied lines of successful research and development problems. Ready to develop your ideas into factory production. Inquiries leading to a permanent connection welcome. PW-702, Chem. & Met. Engrg., Real Estate Trust Bldg., Phila., Pa.

CHEMICAL engineer, 10 years' experience as research chemist and works superintendent in production of heavy chemicals and non-ferrous metals. PW-690, Chem. & Met. Engrg., Real Estate Trust Bldg., Phila., Pa.

WANTED

OXYGEN CYLINDERS

110 and 220 cubic feet capacity. Must be in good condition.

W-718, Chem. and Met. Engrg. 10th Ave. at 36th St., New York City.

POSITIONS WANTED

CHEMICAL, metallurgical engineer, four years' investigation work. Desires teaching or sales position. PW-707, Chemical and Metallurgical Engineering, Leader-News Bldg., Cleveland, Ohio.

CHEMICAL engineer, M.S., Ch.E., 35, married. Ten years' experience in large scale experimental and development work. Desires position solving your difficult chemical engineering or metallurgical problems. PW-716, Chem. & Met. Engrg., Old Colony Bldg., Chicago, Ill.

CHEMIST - metallurgist, American; age thirty, expert all branches analytical chemistry. Skilled in precious metal refining, platinum a specialty. Two years a U. S. Gov. chemist. Experience covers industrial and metallurgical work in Mexico, Cuba, Puerto Rico and United States. Spanish. Position wanted would be that of chief chemist with a concern appreciating solving of operation problems and reduced costs. Employed, available thirty days. PW-717, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

CHEMIST, 10 years' experience as an executive in laboratory and plant. Experience covers the ferrous and non-ferrous fuels, etc. Best of references. PW-708, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

CHEMIST, 27, three years' analytical experience, open for position in chemical laboratory. PW-711, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

CHEMIST, age twenty-five, metallurgical experience, chiefly iron and steel, seeks position where initiative and originality count. PW-715, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

GRADUATE electro chemical engineer, age 30; engaged past four years on development of electrolytic process. Previous experience in electrical lines and in steel making. Would like opportunity with consulting engineer or on experimental work. PW-709, Chem. & Met. Engrg., Real Estate Trust Bldg., Phila., Pa.

METALLURGIST, university graduate, desires new responsible position with manufacturer or consumer of alloy or tool steels. Ten years' experience in laboratory, manufacturing and service work. PW-712, Chem. & Met. Engrg., Leader-News Bldg., Cleveland, Ohio.

PHOSPHATE engineer, technical man, with ten years' experience developing sodium phosphate and other products; guarantees results. PW-700, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

WANTED

Either No. 10 or No. 9

Sweetland Filter Press

Must Be in Good Condition

W-719, Chem. & Met. Engineering Tenth Ave. at 36th St., New York City

To Employers Who Advertise for Men:

The letters you receive in answer to your advertisements are submitted by each of the applicants with the hope of securing the position offered.

When there are many applicants it frequently happens that the only letters acknowledged are those of promising candidates. Others do not receive the slightest indication that their letters have even been received, much less given any consideration. These men often become discouraged, will not respond to future advertisements, and sometimes even question if they are bona fide.

We can guarantee that *Every Advertisement Printed in the Searchlight Section Is Duly Authorized.* Now won't **you** help keep our readers interested in this advertising by acknowledging **every** application received, even if you only return the letters of unsuccessful applicants to them marked, say, "Position filled, thank you." If you don't care to reveal your identity, mail them in plain envelopes.

We suggest this in a spirit of helpful co-operation between employers and the men replying to Positions Vacant advertisements.

Searchlight Department
McGRAW-HILL CO., Inc.

"Put Yourself in the Place of the Other Fellow"

6000

WE WANT YOUR PLATINUM SCRAP

IN ANY FORM

We pay highest market price, make prompt returns and hold goods for your approval. Pure Gold, Silver and Platinum always on hand. Industrial Diamonds and Precious Stones Bought.

I. MILLER, *Smelter and Refiner*, 252 Colonial Arcade, Cleveland, Ohio

POSITIONS WANTED

PLANT executive, graduate chemist, over twenty years' experience in manufacture of heavy chemicals and pigments, at present employed, desires position with good future. PW-687, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

YOUNG man, 22, desires position in the inorganic field. One year's experience in sales on heavy metals. 2½ years government assay work. Opportunity paramount. Salary $30. PW-703, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

SALESMEN WANTED

Wanted: A First-Class Salesman
who has had experience and personal contact with salt cake consumers including paper mills and glass manufacturers; will pay highest salary. Address, with full details, which will be considered confidential, to W. B. Roberts, 505 Merchants National Bank Bldg., Los Angeles, Calif.

REPRESENTATION AVAILABLE

Chemical Engineer
opening sales office in Seattle, wishes to represent manufacturer of chemical or metallurgical machinery or products. RA-692, Chem. & Met. Engrg., Mohr Bldg., San Francisco, Calif.

SALESMEN AVAILABLE

SALES executive, sales engineer or salesman, chemical engineer, 28, thorough plant and broad sales experience in variety of industries, celluloid, rubber, coke and gas, pyroxylin, solvents and derivatives. Capable of becoming sales manager for small concern or district representative for larger concern. Available promptly. SA-694, Chem. & Met. Engrg., 10th Ave. at 36th St., New York.

THE MATHIESON ALKALI WORKS (INC.)

offer for sale

Surplus Equipment at their Saltville, Virginia Plant.
Inspection can be made at any time.
For prices and full information write to
Saltville, Virginia.

Evaporators, New: 4—Buflovak, rapid circulation type, quadruple effect Evaporators and vapor bodies, 108 in. diam.x81-in. cylindrical length, complete with 24-in. Baragwanath Condensers, steam traps, vacuum and tank pumps.

Rotary Filters, New: 2—Rotary Filters, having diameter of 54 in. and width of 15 in., equipped with circular, perforated plates and wire screens.

Direct Current, New Generators: 4—Sprague Electric Co., 250-kw., 250-v., Shunt type Engine Generators, complete with slate panels, with all instruments.

Taylor Stokers, New: 5—3-Retort Taylor Stokers, complete with fans and engines, width of stokers 5 ft., 8 in., depth 9 ft.

Producer Gas, New Machines: 1—Morgan Producer, Gas Machine, 10 ft., 6 in. diam., with rotary measuring feeder, water-cooled leveler, etc.

Harrisburg, Used Engines: 2—Harrisburg-Fleming, Automatic Self-Oiling Engines, 16-in. cylindersx15-in. stroke, 150 hp., at 228 r.p.m., equipped with 44x24-in. rope drive sheaves, 15 grooves, for 1-in. rope.

York Ammonia, Used: Compressors: 2—York Mfg. Co., 14x21, vertical, 2 cylinder, single acting Ammonia Compressor, 65-ton refrigerating capacity, each driven by 20x21-in. horiz., single cylinder Corliss Valve Steam Engine.

FOR SALE OR LEASE

Chemical Plant

on property approximately 330 ft. x 445 ft., with additional lot 100 ft. x 48 ft. Equipped with railroad siding, one large building 122 ft. x 42 ft., two buildings 30 ft. x 30 ft., one building 12 ft. x 30 ft., one boiler house 30 ft. x 30 ft.; two boilers, 1—100 hp. and 1—150 hp. capacity. Plant equipped with pumps, filter presses, steel pressure tanks, open wooden and steel tanks, laboratories; in fact almost all equipment necessary for any chemical operation. Located in Pittsburgh district, on Pennsylvania Lines.

BO-598, Chem. and Met. Engineering
Leader News Bldg., Cleveland, Ohio.

KEHOE

FOR SALE

5—Copper Vacuum Pans, complete with all fittings and vacuum pumps, 60, 150, 180, 250, 400-gal. capacity.
1—Hardinge mill, 8 ft.x22 in., steel lined.
1—No. 7 Sweetland Filter, 27 leaves, 3 in.
1—Oliver, 6x6-ft. Acid-Proof Filter, complete.
2—Type No. 450 Kelly Filters, with pumps.
2—Shriver, 30x30 presses, center feed, open delivery, non-washing, 36 and 45 recessed plates.
1—Sperry, 30x30, Type 57, 16 plates and frames, open delivery, washing type.
1—Buffalo, 48x20-in. Vacuum Drum Dryer.
1—Buffalo, 2 ft., 4-in.x4-ft. Rotary Vacuum Dryer, complete.

ROBERT P. KEHOE
7 East 42nd St., New York
Three Yards in New York City

FOR SALE

Limited number of new and slightly used **Taylor Recording Thermometers**, range 0.75 C.
Also **Thwing Electrical Pyrometers**, new, for base metal couples, range 0-900 Cent. Complete in case with twelve point switch.
MORSE & COMPANY
2 Lilly St., Newburgh, New York.

FOR SALE

Machinery

3—1000 gal. **Jacketed Sulphonators.**
2— 400 gal. **Jacketed Sulphonators.**
1— 400 gal. **Steel Mixing Kettle.**
1— 350 gal. **Steel Mixer.**
1— 75 gal. **Jacketed Sulphonator.**
6— 450 gal. **Day Jumbo Mixers.**
1— 400 gal. **Stokes Mixer.**
1— 40 gal. **Ross Mixer.**
1— 8 gal. **Ross Mixer.**
1—150 gal. **Copper Jacketed Still.**
9—**Aluminum Stills**, Capacities 55, 80, 115 and 140 gals. New.
7—80 gal. **C. I. Jacketed Stills.**
1—75 gal. **Jacketed Copper Still.**
1—Devine Laboratory **Vacuum Shelf Drier**; 5 shelves.
2—Devine **Driers**, 20 shelves.
2—Rotary **Driers**, 32 in. x 8 ft.
1—30 in. sq. **Cast Iron Filter Press.**
1—30 in. sq. **Wooden Filter Press.**
1—24 in. sq. **Cast Iron Filter Press.**
1—24 in. sq. **Wooden Filter Press.**
1—18 in. sq. **Wooden Filter Press.**
90—**Aluminum Kettles**: jacketed, cover, stand and fittings; Capacities 40, 60, 80 and 100 gals.
25—**Jacketed Dopp Kettles**; Capacities 40, 60, 75, and 120 gals.
3—30 gal. Enamelled **Jacketed Kettles.**
2—150-hp. Bridgeport **Boilers**, complete.
1—150-hp. Dillon **H. R. T. Boiler.**
1—120-hp. **Boiler**, complete.
1— 7-hp. **Boiler.**

Machinery & Equipment Co., Inc.
225-231 Sherman Ave., Newark, N. J.

FOR SALE

4—Motor driven Sharples **Centrifuges.**
2—**Pebble Mills**, porcelain lined, with pebbles, 36x42 in.
1—**Tube Mill**, stone lined, 4x16 ft.
6—**Filter Presses**, cast iron, 18 in., 24 in., 30 in., 36 in.
12—**Paint Mixers**, 100 gal.
9—Gordon Atmospheric **Dryers**, 300 to 1,500 sq. ft.
7—Devine and Buffalo Vacuum **Shelf Dryers.**

P. O. BOX 552, CITY HALL STATION
New York City

TECHNICAL MACHINERY

10—Welded Steel Autoclaves.
70—42-in. Centrifugal Wringers, direct connected to 40 hp. vertical motors, complete.
4—Sets, 3 wringers to a set, 30-in. belt-driven Centrifugal Wringers.
50—3-in. Centrifugal Submerged Acid Pumps.
6—Baker and Shevlin Centrifugal Screens.
1—Aniline Distilling Outfit, consisting of kettle or aniline boiler, column, dephlegmator, condenser and fittings.
2—Special 7,000-lb. Nitrators, consisting of steel tank, stirring apparatus and coils.
8—Steel Condensers, with coils and manifolds.
56—Universal Kneading and Mixing Machines, 100-gallon capacity. Werner and Pfleiderer make.
6—Mammoth Jr. Jordan Engines. Noble and Wood make.
35—Welded Steel Digesters, capacity 1,300 cu. ft. Pressure 110 lbs.
20—Cotton Dryers, Sargent make, complete with mixing pickers, washers, rolls, concentrators, feeders, coils and fittings.

Write for specifications and prices.

OLD HICKORY POWDER PLANT
Old Hickory, Tennessee

FOR SALE

1—5x12 Buffalo Atmospheric **Drum Dryer.**
1—Devine cylindrical **Shelf Dryer.**
1—No. 5; 1—No. 7, 2—No. 10, 2—No. 12 Sweetland **Filters.**
1—12-in. Shriver, closed delivery **Filter Press.**
2—30 gal. copper jacketed **Kettles.**
1—50 gal. Burkhart steam jacketed copper **Vacuum Still.**
1—10 gal. cast iron Elyria lined **Iron Still.**

Boilers, Kettles, Pebble and Ball Mills, Tanks, Etc.

W. H. CAMPBELL, Inc.
30 Church St., New York City.

Transformers

All Single Phase, 60 Cycle

14—10 kva. Westinghouse Type S. 2200 to 220/110 v.
8—10 kva. G. E., Type H. 2200-110/220 v.
1—15 kva. G. E., Type S. 2200 to 220/110 v.
1—15 kva. G. E., Type H. 2200-110/220 v.
1—50 kva. Westinghouse, Type S. 2400-480/240 v.
3—100 kva. Westinghouse, S. K., Outdoor Type, 6600 to 2200/2000 v.
12—250 kva. Allis-Chalmers, Outdoor Type, 2300 to 230/460 v.
15—250 kva. Westinghouse, Outdoor Type, 2300 to 460/230 v.
3—600 kva. Westinghouse (40° C.), Outdoor Type. 600-1200-2400 v. primary, 6600 v. secondary. Transformers arranged with taps for starting 300-hp., 2200-v., 3-ph. motors. Transformers on new A.I.E.E. rating at 55° C., 750 kva.

Write for Bargain Prices

OLD HICKORY POWDER PLANT
Old Hickory, Tennessee

WE OFFER FROM OUR OWN STOCK:

DRYERS
12—Vacuum Shelf Dryers, 27, 23, and 11.
2—Bronze Vac. Drum Dryers, Devine, 40-80 in.
1—4x30-ft. American Process Rotary Dryer.
1—4x20-ft. Rotary Vacuum Dryer.
2—5x33-ft. Rotary Vacuum Dryers.
1—4x 8-ft. Atmospheric Drum Dryer.
1—4x10-ft. Atmospheric Double Drum Dryer.
5—Gordon Shelf Dryers.

DISTILLING APPARATUS
2—60-in. Copper Column Units.
1—54-in. Copper Column Unit.
1—24-in. Copper Column Unit.
1—12-in. Copper Column Unit.
5—Copper Vacuum Stills, 30, 75, 300 gal.
6—Aluminum Stills, 100 gal.

REFRIGERATING PLANTS
6—Brunswick & York, 2, 4, 6, 8, and 10 tons.

FILTER PRESSES
9—Sweetland Nos. 12, 10, 9, 7, 5, and 1.
9—Kelly Nos. 850, 450, 250, and 150.
1—Oliver all iron, 4x6 ft.
1—Industrial, 6x5 ft., 2—Oliver, 6x6 ft.
3—42x42-in. Wood Filter Presses.
3—30x30-in. Wood Filter Presses.
2—24x24-in. Wood Filter Presses.
10—18x18-in. Iron Filter Presses.
2—24x24-in. Iron Filter Presses.

FILTER PRESSES (Continued)
1—36-in. Iron Filter Press.
1—42x42-in. Iron Filter Press.
9—36-in. Wood Filters.

CENTRIFUGALS
5—26-in. Cop. Baskets. 1—28-in. Cop. Basket.
2—36-in. Steel Baskets. 3—36-in. Cop. Bkts.
2—36-in. Bronze Baskets.
1—40-in. Copper Basket 1—42-in. Steel Basket.
2—48-in. Copper Baskets.
1—60-in. Copper Basket.

KETTLES, JACKETED
50— 80-gal., aluminum.
12— 80-gal., Iron.
20— 40-gal., iron.
20— 40-gal., iron. 15—60-gal., iron.
1—150-gal., enameled, agitated.
3—800-gal., cast iron. 1—1600-gal. nitrator.

GRINDERS AND PULVERIZERS
1—No. 0000 Raymond Mill.
1—20-in. Schutz-O'Neil.
2—4x 16, Silex Lined Tube Mills.
2—3x3½, Silex Lined Ball Mills.

WERNER AND PFLEIDERER MIXER
7—Size XV, 100 gal.
2—Size XVII, 200 gal.
1—100-gal. Vacuum Mixer.
1—20-gal. Laboratory Mixer, complete.

CONSOLIDATED PRODUCTS CO., Inc.

Phone Barclay 0603
Wire—Phone—Write

Cable Address, Equipment
15 Park Row, New York City

Stirling Boilers

823 Horsepower

Class M-30 823 hp. Babcock and Wilcox Stirling Water Tube Boilers, 200 lbs. pressure. Drums double riveted, double strap butt joint. Complete with Westinghouse stokers, forced draft fans, Vulcan soot blowers and all accessories.

Operated less than 90 days.

Inspection Invited
Send for Specification Folder.

OLD HICKORY POWDER PLANT
Old Hickory, Tennessee

New Dryers

Unusual bargain of 20 Steam-heated Air Dryers, 4 ft. 0 in. diameter, 30 ft. long, for chemicals, intended for Government use during war. Write us for particulars.

McDermott Bros. Co.
Allentown, Penna.

MIXERS

For Sale Cheap

90—Werner & Pfleiderer Mixers Size 15, Type B.B. Write for details and prices.

OLD HICKORY POWDER PLANT
Old Hickory, Tennessee

KELLY FILTERS

Loaned, bought and sold after thorough overhauling. Special parts of any description—leaves, bags, gaskets at lowest prices.

EMIL E. LUNGWITZ
90 West Street, New York.

New and Used Scales

Guaranteed in First Class Condition

Howe and Fairbanks Makes.
Flour, truck, stock, tank and special scales.
Write for Bulletin No. 20

OLD HICKORY POWDER PLANT
Old Hickory, Tennessee

"PERFECTION" DRYERS

Rebuilt shelf or truck type, high efficiency atmospheric dryers. Special problems investigated. Dryers designed and completely installed.

PERFECTION DRYER COMPANY
15 Park Row, New York City.

The "Searchlight" Advertising in This Paper

is read by men whose success depends upon thorough knowledge of means to an end—whether it be the securing of a good second-hand piece of apparatus at a moderate price, or an expert employee.

THE BEST PROOF

of this is the variety of this journal's Searchlight ads. Without a constant and appreciable *demand* for such machinery or services, by its readers, the market place which these advertisements represent could not exist for any length of time.

Are *you* using the Searchlight Section?

0316

320

Can you convert or use
paraffined duck in any of your products?

The Chemical Wai fare Service offers half a million yards of it in lots of 5000 yards or more

Millions of yards of paraffined olive drab duck were made for the War Department to protect the soldiers' gas masks. The remaining surplus is now offered to industry or the trade at the highest price bid at public auction in Boston, Mass., January 17th.

It is possible some manufacturer of imitation leather, rubber or other fabric can put this to work as a base fabric for such material, or convert it into commercial duck. The quantity on hand is approximately 558,190 yards, stored at Edgewood Arsenal, Md., where inspection is invited between the hours of 10 A.M. and 2 P.M., except Saturday and Sunday. This will be offered by sample in 5,000-yd. lots or larger at the Quartermaster Auction, Army Supply Base, Boston, Mass. It is 12.5 duck, width 29-29½ in.

It may mean many dollars' profit to some fabric manufacturer by sending a representative to Edgewood Arsenal to inspect this duck. Write for the Boston catalog, which gives all terms of sale and description of this material. Copy may be procured from the Q. M. Supply Officer, 1st Ave. & 59th St., Brooklyn, N. Y., or the Commanding Officer, Army Supply Base, Boston, Mass.

At the same time and place the Quartermaster Corps is offering 1,249,801 yds. of commercial duck of miscellaneous widths, weights and shades, a number of used machine tools and motors. This material is listed in the above mentioned catalog.

The Government reserves the right to reject any or all bids.

Send for catalog

Inspect Material

Attend Auction at Boston, Mass. January 17th

WAR DEPARTMENT

WHAT AND WHERE TO BUY

A Classified Index of Advertisers in this Issue

For Alphabetical Index See Last Page

Acetylene—Dissolved
Prest-o-lite Co.

Acid Concentration App.
Duriron Co.
Pacific Foundry Co.

Acid Eggs
Bethlehem Fy. & M'ch. Corp.

Agitators
Petroleum Iron Works Co.

Air Conditioning
American Blower Co.
Parks-Cramer Co.
Sturtevant Co., B. F.

Air Lifts, Pumping Supplies
Sullivan Machinery Co.

Air Meters
See Meters, Flow, Air, etc.

Air Receivers & Aftercoolers
Parks-Cramer Co.
Petroleum Iron Works Co.

Alcohol
Industrial Chemical Co.

Alloys, Manganese
Electro Metallurgical Sales Corp'n.

Alloys, Steel
Ohio Steel Foundry Co.

Ammeters
Weston Electrical Instrument Co.

Analytical Apparatus
Braun Corporation
Braun-Knecht-Heimann Co.
Denver Fire Clay Co.
Eimer & Amend
Hoskins Mfg. Co.

Ash Handling Machinery
Jeffrey Manufacturing Co.

Autoclaves
Bethlehem Fdy. & Mach. Co.
Buffalo Fdy. & Mach. Co.
Devine Co., J. P.
Stokes Mach. Co., F. J.
Valley Iron Works
Vulcan Iron Works

Balances and Weights
Eimer & Amend

Barrels, Steel
Petroleum Iron Works Co.

Bars, Iron and Steel
Ryerson & Son

Baskets, Dipping
Tyler Co., W. S.

Belt Conveyors
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Bins, Steel
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Bleaching Cells
International Electrolytic Plant Co., Ltd.

Blowers, Fan or Rotary
American Blower Co.
Connersville Blower Co.
Duriron Co.
Judelson Evapo-Dryer Corp.
Roots Co., P. H. & F. M.
Sturtevant Co., B. F.

Books, Technical
McGraw-Hill Book Co.

Boiler Covering
Celite Products Co.

Boiler Meters
See Meters, Flow, Air, etc.

Boiler Tubes and Fittings
Crane Co.
Ryerson & Son
Vogt Mach. Co., H.

Boilers
Babcock & Wilcox
Vogt Mach. Co., H.

Brick & Clay, Acid Proof
Harbison-Walker Refractories Co.

Brick & Clay, Fire
Harbison-Walker Refractories Co.
Vitrefrax Co.

Brick & Tile, Acid Proof
Knight, Maurice A.

Brick, Blocks, Powder Insulating
Celite Products Co.

Brick, Chrome, Magnesia & Silica
Lavino & Co., E. J.

Brimstone
Union Sulphur Co.

Bucket Elevators
Caldwell, H. W., & Son Co.
Jeffrey Manufacturing Co.
Sturtevant Mill Co.

Buckets, Clamshell and Dragline
Industrail Works
Orton & Steinbrenner Co.

Buckets, Clamshell & Grab
Industrial Works

Burners, Gas and Oil
Best Corp'n., W. N.
Denver Fire Clay Co.
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Parks-Cramer Co.

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McGann Mfg. Co.

Calorimeters
Eimer & Amend

Carbonizing Boxes
Electro Alloys Co.
Pusey and Jones Co.

Carbon Black
Industrial Chemical Co.

Carbon Dioxide Gas, Co.
Liquid Carbonic Co.

Carbons, Refining, Purifying Developing, Deodorizing
Industrial Chemical Co.

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See Stoneware, Chem.

Cars, Tank
Petroleum Iron Works Co.

Casseroles
Coors Porcelain Co.

Castings, Acid Proof
Bethlehem Fdy. & Mach. Co.
Duriron Co.
Hurt Engrg. Corp., Geo. F.
Pacific Fdy. Co.
Pusey and Jones Co.

Castings, Chemical
Buffalo Fdy. & Mach. Co.
Duriron Co.
Fuller-Lehigh Co.
Pusey and Jones Co.
Sperry, D. R. & Co.

Castings, Heat and Acid Resisting
Electro Alloys Co.

Castings, Iron
Bethlehem Fdy. & Mach. Corp.
Buffalo Fdy. & Mach. Co.
Fletcher Works
Vogt Mach. Co., H.

Castings, Special and Chilled
Vulcan Iron Works

Caustic Pots
Bethlehem Fy. & Mch. Corp.
Buffalo Fdy. & Mach. Co.

Caustic Soda and Chlorine Plants
Elektrokemiska Aktiebolaget
Pennsylvania Salt Mfg. Co.

Causticizing Apparatus
Buffalo Fdy. & Mach. Co.
Zaremba Co.

Cement, Acid Proof
Harbison-Walker Refractories Co.
Knight, M. A.

Cement Cloth
Cleveland Wire Cloth & Mfg. Co.
Ludlow-Saylor Wire Co.

Cement, Furnace
Vitrefrax Co.

Cement, High Temperature
Celite Products Co.
Harbison-Walker Refractories Co.
Lavino & Co., E. J.

Cement, Insulating
Celite Products Co.

Cement Refractory
Vitrefrax Co.

Centrifugals
American Tool & Mach. Co.
Fletcher Works
Tolhurst Machine Works

Centrifugals, Dehydrating
Fletcher Works
Tolhurst Machine Works

Ceramic Ware
Vitrefrax Co.

Charcoal
Industrial Chemical Co.

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See Stoneware, Chem., etc.

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Denver Fire Clay Co.
Eimer & Amend

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Chrome Ore
Lavino & Co., E. J.

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Cloths and Felts Mechanical
Duro Co., The

Coal Meters
See Meters, Flow, Air, etc.

Cocks and Bibbs
See Pipe and Fittings

Coils and Bends
Crane Co.

Condensation Products
Bakelite Corp'n.

Condensers, Barometric, Surface or Jet
American Steam Pump Co.
Buffalo Fdy. & Mach. Co.
Devine Co., J. P.

Containers, Heat Treating
Hoskins Mfg. Co.

Controllers, Temperature
Crane Co.
Foxboro Co., Inc., The

Conveyors, Belt
Bartlett & Snow Co.
Caldwell, H. W. & Son
Goodrich Rubber Co., B. F.
Jeffrey Mfg. Co.
Sturtevant Mill Co.

Conveyors, Portable
Jeffrey Manufacturing Co.

Couplings, Flexible Shaft
Crane Co.

Cranes, Crawling Tractor
Industrial Works

Cranes, Locomotive
Industrial Works
Orton & Steinbrenner Co.

Crucibles, Graphite
Bartley Crucible Co.

Crucibles, Industrial
Bartley Crucible Co.

Crucibles, Laboratory
American Platinum Works

Crushers, Grinding Mills and Pulverizers
Raymond Bros. Engrg. Co.
Raymond Bros. Impact Pulverizer Co.

Crystalling
Sturtevant Mill Co.
See Pans, Vacuum

Crystallizing Tanks, Wood
Hauser Stander Tank Co.

Cutters, Pipe, Hand
Toledo Pipe Threading Machine Co.

Dies, Pipe, Threading
Toledo Pipe Threading Machine Co.

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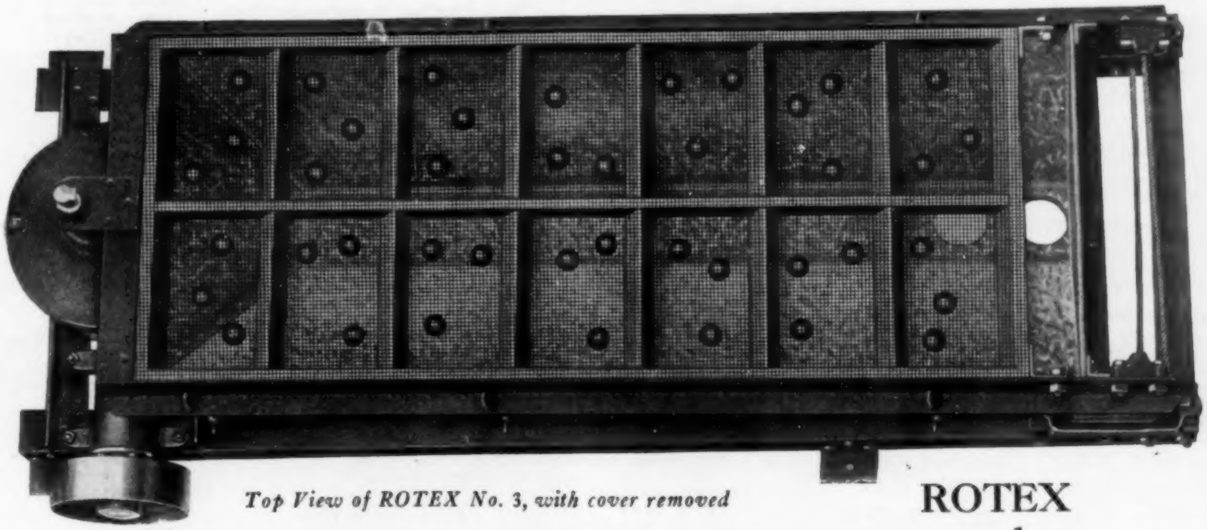

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Vitrefrax Company,
Los Angeles, Calif.

Gentlemen:

We believe you will be interested to know that your "DUROX NOZZLES" have completely solved a very troublesome problem in our Electric Steel Foundry.

We are melting high grade electric steel in a three ton Moore Furnace, basic operation, in which we charge five tons per heat. Some of our manufactured castings are very small and light, we are pouring these with a five ton ladle, necessitating a pouring temperature greatly in excess of that usually required for ingots or large castings.

We have tried practically every type of nozzle that we could obtain, and practically all were worthless after a few moulds had been poured owing to the corrosive action of the super-heated steel. In fact, we had almost begun to despair of pouring any number of moulds from the same ladle, when one of your service engineers suggested that we try a DUROX NOZZLE which he stated was made of a crystalline product of the electric furnace.

The first DUROX NOZZLE showed us we had our problem solved, we have used them continously ever since and are able to pour our complete heat, from 100 to 200 moulds with the same ease and assurance we would have opening and closing a water faucet. The nozzle shoots perfectly straight and without any spraying whatsoever.

We are really very enthusiastic over this nozzle and feel that had we known of it last year it would have saved us a great deal of money, while the price of the DUROX NOZZLE is considerable more, they have saved us so many times their cost that we are almost ashamed to bring up the question at all.

Thanking you for your help, we remain

Very truly yours,
J. N. Buckley
KEYSTONE IRON & STEEL WORKS.

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is but one of many

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